

ANNALS
OF
OTOLOGY, RHINOLOGY
AND
LARYNGOLOGY

INCORPORATING THE INDEX OF OTOLARYNGOLOGY.

VOL. XXIX.

JUNE, 1920.

No. 2.

XLII.

SERIOUS COMPLICATIONS IN THE PUNCTURE OF
THE MAXILLARY ANTRUM. INVESTIGATIONS,
BY EXPERIMENTS ON ANIMALS, OF THE
REFLEXES PRODUCED FROM THE MU-
COUS MEMBRANE OF THE AN-
TRUM. AIR EMBOLI AFTER
ANTRUM PUNCTURE.

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It is a well known fact that occasionally, though fortunately seldom, puncture of the maxillary antrum may be attended with surprising and alarming phenomena in the form of long attacks of unconsciousness, often accompanied by convulsions. In the special literature available to me, I have found only nine fairly satisfactorily described cases, where the phenomena

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in question have been observed. Boenninghaus may, however, be right in saying that alarming symptoms after antrum puncture occur more frequently than is generally known. In my own practice and that of some of my colleagues no less than seven cases have been met with, a fact that seems to indicate that these dangerous complications are less uncommon than might be supposed, judging from the literature on the subject.

And even if these phenomena occur seldom, a great deal of attention should be paid to them as no less than the patient's life or health is at stake. In the nine cases found in the literature death supervened four times and in the seven cases collected by me, twice. There are evidently very good reasons for examining the various factors that may have brought about this result, especially as, to my knowledge, no satisfactory explanation of the mystical antrum exists. In this connection it may therefore be of interest to give a survey of the cases already published and of those met with in my own practice. The best known cases in the literature on the subject are probably the four mentioned by Claus.

1. A young girl of 19 had twice in the course of five years been treated for a left-sided maxillary inflammation. On both occasions a fairly large opening was made into the antrum through the lower meatus. Two years after the second treatment there was another recurrence of her antrum empyema. By that time there remained only a small fistula barely large enough for the passage of a probe through the previous opening in the lateral wall. A new puncture was therefore made with the commonly used Lichtwitz needle. It then appeared that the bone was so greatly thickened that the needle could hardly be made to penetrate it. An entrance into the antrum was however, successfully effected, and the air could be heard passing into the nose when the syringe was used. Suddenly the air met with considerable resistance, so that more than ordinary force had to be employed in order to compress the bulb. At the same moment the patient became cyanosed, with dyspnea and a feeling of fear, but with a strong, quiet pulse (75). She was immediately placed in a horizontal position and then quickly recovered, the cyanosis and dyspnea disappearing in the course of about ten minutes. There remained, how-

ever, a peculiar feeling of oppression for a couple of hours, but the next day she was as well as ever. The author supposes it to be a case of air embolism. The needle might possibly have been drawn backwards in the thick bone channel and the air driven into the cancellous portion of the bone.

2. A man, aged 68, suddenly lost consciousness after puncture of the antrum. On closer examination it appeared that the patient's right arm and leg were paralyzed, but not his face, and that he was unconscious and did not answer when addressed. Pulse strong and regular. On the following day the patient was clearer; he knew the doctor and could name various objects. His speech, however, was indistinct. He was able even then to move his right arm, and six days later no paralytic phenomena were apparent. Claus has here diagnosed cerebral apoplexy in the left hemisphere. He also does not consider it impossible that this has been a case of arterial spasm, a poisonous effect of the novocain adrenalin administered.

3. A young woman was treated with irrigation of the right maxillary antrum, and was twice syringed without unpleasant consequences. Immediately after a third syringing, cyanosis suddenly supervened, with loss of consciousness and an uncountable pulse, stertorous breathing and fixed pupil. Notwithstanding the administration of stimulants and artificial respiration, death occurred shortly. The anesthetic employed was six drops of a 10 per cent novocain solution with three drops of adrenalin in 20 minutes. The postmortem gave entirely negative results. According to Claus' view, the patient died of heart paralysis as a consequence of novocain poisoning.

4. A woman, aged 36, was anesthetized with a 10 per cent novocain suprarenin solution (1 per cent of an adrenalin solution 1/1,000) applied to the lower meatus on a tampon, and followed by painting 10 per cent cocain on a thin swab over the inferior turbinated bone and inferior meatus. Puncturing of the antrum was thereupon performed without difficulty with a Lichtwitz needle, and air was then injected into the antrum. At the same moment the patient lost consciousness, with suspended pulse and respiration. After camphor caffein injections and a saline infusion the pulse and respiration im-

proved; but consciousness did not return and the comatose condition passed into death.

At the postmortem examination there was found, among other things, a hemorrhagic infiltration, 5 centimeters in length and 2 centimeters in width, in the epicardium of the right ventricle. The infiltration could be traced right through the ventricular wall into the endocardium. A similar infiltration was also seen in the septum membranaceum. The heart, which was opened under water, contained no air. In the gray matter of the brain some slight hemorrhages were found. After opening the fourth ventricle, extravasations were also observable in the arbor vitæ and in the lower part of the cerebellum.

In this case, too, Claus considers that novocain poisoning was the cause of death.

Among other writers, Hajek, in his "Pathologie und Therapie der Nebenhöhlen der Nase," points out that long attacks of unconsciousness may now and then occur in connection with exploratory punctures. These must not be confounded with the slight fainting fits that are not infrequently seen during intranasal manipulations, due partly to the effect of the cocain and partly to the feeling of fear and the psychic shock which often attend the operations. The long attacks of unconsciousness "durch den Eingriff ausgelöste hysterio-epileptische Anfälle," may last for hours, and are not infrequently associated with convulsions. Hajek has repeatedly observed, especially in patients with a narrow ostium maxillare and a bad outlet for the fluid, long periods of malaise with cold sweats and palpitations, and slow strained pulse (down to 60 as against 70 and 80 normally). The author considers these symptoms as the expression of a vagus irritation produced reflexly through irritation of the second branch of the trigeminal. Hajek once had a case of true apoplexy after antrum puncture, from which the patient, a diabetic, with arteriosclerosis, died within 24 hours.

Killian, in 1913, at a meeting of the German laryngologists at Stuttgart, described a case of sudden "antrum death" after syringing of the antrum. A postmortem, with special examination of this cavity, gave an entirely negative result. The only thing that could be definitely established was that the syringed water had been cold. During the discussion that

followed, Streit (Königsberg) stated that after syringing through the middle nasal fossa, he had observed temporary paralysis of both legs, and temporary disturbance of vision. Siebenmann (Basel) considered the attacks of giddiness after irrigation of the antrum to be action of the vagus produced by trigeminal irritation.

Neuenborn treated a young man of 23 for double sided antrum empyema. On the left side puncture and syringing were twice performed without inconvenience of any kind. Two days after the second treatment the right antrum was punctured, with subsequent evacuation of pus and injection of air. Immediately after the removal of the canula, the patient fell from his chair, respiration ceased and the pupils were fixed and dilated to the maximum. His face was pale with cyanosed lips. His entire body was rigid and in a condition resembling that of tetanus, so that artificial respiration could not be proceeded with, owing to muscular spasms. The pulse was good and regular, 72. Massage of the diaphragm was performed until, after 25 minutes, spontaneous respiratory movements recommenced. These were at first irregular, with frequent interruptions, and the massage had therefore to be continued. After some time the condition of tonic spasms improved, but became worse again directly an arm or leg was moved. It was only after two hours that the spastic condition passed away; but it returned again later with tonic spasms alternating with clonic contractions. The pupils were still fixed and dilated to the maximum. During the three following days the patient was unconscious, but with normal pulse and temperature, except for one rise in the latter to 38.2 the day after the first attack. On the fourth day after the puncture, consciousness began to return. The patient then complained of headache and nerve pains with spots specially tender to pressure over the trigeminus and the ischiadicus.

The author maintains that this was a case of cocain poisoning. He recalls, in this connection, E. Falk's investigation of the toxic effects of cocain, according to which the respiration is first of all affected, and that consequently a death from cocain is due to a cessation of respiration. The above case, with good, strong pulse all the time, would therefore

answer particularly well to the characteristic picture of cocain poisoning. Neuenborn does not, however, seem to be quite sure of the matter. He points out, for instance, that the cocain solution ($7\frac{1}{2}$ per cent, of which about 0.1 gm. was soaked up into a thin wool swab for painting three times) was very weak, the patient moreover having repeatedly been anesthetized before with the same solution. The author therefore believes that something else may have supervened, which he cannot explain, but imagines must be sought in the actual syringing.

Henrici has also described two cases that are of considerable interest. In the one case, in which the patient suffered from empyema and formation of polypi, the polypi were removed under local anesthesia, with subsequent irrigation of the frontal and maxillary sinuses. While one of the antrums was being syringed the patient suddenly collapsed and had an epileptoid attack, with cyanosis and trismus. Respiration was labored, and the pulse weak and irregular. The pupils were fixed. The patient recovered quickly, however, apparently without unpleasant consequences. The following day the antrum was again syringed. The result was the same as before. The lockjaw this time was so severe that the mouth could not be opened with a gag. The chest was quite rigid as a probable consequence of the spasmodic contraction of the respiratory muscles. Even after tracheotomy it was impossible to carry out artificial respiration, and the patient died without regaining consciousness. A postmortem examination gave an entirely negative result.

In the second of Henrici's patients, too, nasal polypi were removed under cocain. After 10 per cent cocain applications to the middle meatus, the antrum was to be syringed through the middle nasal fossa. As soon as the syringing began, an epileptoid attack occurred also in this case, with labored respiration, cyanosed face, and clonic contractions in the arms and legs. The pulse was suspended. Under artificial respiration and heart massage, the patient grew rapidly better, but for a time both arms and legs were paraplegic. For a little time after the attack, she was not quite mentally clear. She was unable, for instance, to explain where she was. By degrees, however, all the phenomena disappeared; but for

two or three years after the treatment the patient felt a weariness in her arms and legs, and was forgetful and listless. Henrici draws attention to the fact that neither of his patients suffered from epilepsy or any other inherited ailment. He could not explain the cause of the attacks, nor whether it was cocain or some other factor that had contributed to their occurrence.

Zarniko gives an account, in his textbook, "*Die Krankheiten der Nase und des Nasenrachens*," of a woman of 50 who was subjected to a puncture of the antrum. The perforation was made through the lower nasal fossa, and the operation was performed with the greatest ease. When Zarniko proceeded, after injecting air, to rinse out the cavity, the patient suddenly collapsed with a sigh. Her face was pale, the skin cold and covered with perspiration. The pupils were fixed and dilated to the maximum, and the pulse and respiration were suspended. She was immediately placed upon the floor, and artificial respiration was begun. The patient's condition was very critical, and Zarniko even feared that death might occur at any moment. By means of artificial respiration and stimuli, however, the color was brought back after a time to the bloodless lips; a faint moaning respiration was heard, and the patient awoke to consciousness. In the course of an hour she was able to go home. The author considers this collapse to have been only a result of trigeminal irritation. The patient was not weak or apprehensive, and had had cocain several times before without any poison effect having been observed.

From these cases it will be seen that the literature on the subject contains only scanty information regarding bad results after puncture of the antrum. A continued search might possibly bring others to light, but it is not likely that their number would be very great. The literature does not, however, give an entirely correct representation of the matter as it appears in practice. These tragic cases, indeed, are rare, but scarcely as rare as our literature on the subject would make it appear.

In addition to the cases mentioned above, I shall describe four that have occurred in my own practice.

1. A man of 51 had been for some considerable time under treatment for double sided acute antrum empyema. On the left side the antrum, after local anesthesia with 10 and 20 per cent cocain solution, was punctured and then syringed several times through the artificial aperture without causing any inconvenience to the patient. As the secretion on the right side, in spite of conservative treatment, continued undiminished for a considerable period, an opening was to be made here too into the antrum. An exploratory perforation was first made with the ordinary Lichtwitz needle through the lower meatus. The bony wall on the right side, like that on the left, was hard and thick. After it had been perforated, air was as usual first introduced in order to find out whether the ostium maxillare was permeable. It then appeared that the air injected met with considerable resistance. At the same time a peculiar bubbling sound was heard inside the antrum, and suddenly the patient sank down unconscious, his face becoming cyanosed. Respiration had ceased instantaneously in the inspiratory position. The jaws were firmly pressed together, and the whole body was rigid, as if the muscles of both the trunk and the extremities were in a condition of general tetanic contraction. The pupils were not especially dilated, but were completely fixed. The pulse, which at first could not be counted, was later felt to be rapid, irregular and small. How long this condition of absolute cessation of respiration lasted cannot exactly be said. A wedge was quickly, though with considerable difficulty, pushed in between the teeth, and the tongue drawn forward, whereupon a few irregular stertorous respirations occurred. The convulsive rigidity of the extremities at the same time gave place to clonic contractions in the upper and lower extremities. As soon as possible, after camphor caffein injections, artificial respiration was begun and carried on without much difficulty after the tonic spasms had ceased. The patient's condition now gradually improved. The irregular, stertorous breathing ceased and the cyanosis disappeared. After about 20 minutes consciousness returned. The patient was immediately put to bed, and by the next day was well enough to be discharged. For several weeks, however, he felt tired and without interest in his work.

According to his own statement, the patient had always been strong and well, and in his own opinion bore physical exertion without difficulty. He did not give one the impression, however, of being a strong man, but on the contrary looked delicate. It was subsequently stated by his relatives that 30 years previously he had had two epileptic fits, but as far as they knew there had been no recurrence of them. There was, moreover, epilepsy in his family, two brothers who died at the age of 35 having suffered much from that disease. There was nothing remarkable about the heart and lungs. The urine showed normal conditions. Has since been repeatedly examined by internists with negative results.

2. A man of 54 had been treated for acute left sided influenza otitis with paracentesis. On account of constant violent pain in the left half of the face and in the teeth on the same side, a puncture of the maxillary sinus was performed in order to ascertain whether inflammation of that cavity was the cause of the pain. The perforation of the bone, which was performed under cocain, with a 10 and 20 per cent solution, required the exercise of considerable force, as the bone in the lower meatus was thick and hard, so that the trocar only penetrated by slow degrees. During the injection of air, a bubbling sound was heard and interpreted as a collection of fluid in the cavity. In this patient, too, the air appeared to meet with more resistance than usual, though not greater than may often be experienced when the ostium maxillare is narrow. It was therefore thought that syringing could be carried out without risk. Just as the syringe was being transferred, however, after the injection of air, to the water vessel, the patient dropped from his chair under circumstances resembling those just described in the case of the first patient, with cyanosis, absolute cessation of respiration, fixed pupils not greatly dilated, uncountable pulse. Both body and extremities were rigid, the entire muscular system being in a condition of general tetanic contraction. Notwithstanding the trismus that was present, we succeeded in opening the mouth and drawing the tongue forward, whereupon artificial respiration was begun. The continued respiratory spasm, however, at first occasioned very great difficulty; but after a time, it is not known how long, involuntary respiratory movements could be ob-

served, the first very shallow and irregular, but, with continued artificial respiration, becoming constantly deeper. After camphor caffein injections, the pulse could once more be felt. It was feeble, irregular and rapid, 100 to 120. After from 15 to 20 minutes the corneal reflex returned, and after about 30 minutes the patient regained consciousness, though at first he was confused. He did not know, for instance, where he was; and it was not until half an hour later that his mind became sufficiently clear for him to understand his surroundings in a measure. In contrast to the first mentioned case, there were no convulsive movements. The muscles of both the trunk and the extremities appeared throughout the attack to be spastically contracted. After the attack, too, the condition of tetanic irritation continued in upper and lower extremities. Arms and legs were thus rigid, and could not be actively moved, and passively only with difficulty. At the same time the patient complained of a peculiar feeling of numbness, especially in hands and feet. His condition improved, however, rapidly. In the course of an hour he was once more able to move his arms and legs, though not without considerable difficulty. If he attempted, for instance, to raise his right or left hand to his mouth, he failed to do so, the hand moving out to the side. If he wanted to move his foot from one side to the other towards a certain point, the leg, indeed, could be carried over in the right direction, but the foot kicked out into the air when it was meant to touch the given point. The patellar reflex was lively, but did not appear to be increased to any great extent. The same evening, six hours after the trauma, the arms could be moved considerably better, but did not regain their full power until the next day. For a long time, however, the pressure of the left hand was weaker than that of the right. The patient had to remain in bed until the second day after the puncture. The right leg was then sufficiently well for him to be able, when supported, to limp across the room; but it was not until the fourth day after the attack that the left leg could be used with any feeling of security. The numbness, which was strongly marked in the left leg, especially during the first few days after the trauma, was also sufficient to necessitate the use of a stick during the six to eight weeks following.

Three years later the patient still complained of feeling a little numb in his left foot, especially in the second and third toes, so that he felt insecure when, for instance, he went up or down stairs. A thorough examination was then made by a nerve specialist, but no disturbance of sensation could be found.

It was considered that the idea of disease of an organic nature was on the whole precluded.

The patient was a slight, somewhat nervous and overworked man, but was considered to be energetic and capable in his calling. Had further always had good health except when, during a very fatiguing visit to America, he had been rather subject to heart trouble. Had never had epilepsy nor was that disease in his family. Lues was denied, and Wassermann was negative. There was nothing remarkable about the heart, lungs and urine, either in this or in any subsequent examination by specialists for internal medicine. A skiagram of the maxillary antra showed both to be large and well developed.

2. In a farmer of 61, with symptoms of an empyema of the antrum of Highmore, the antra were about to be examined. After local anesthesia of the left lower meatus with a 20 per cent cocain solution, the perforation was performed quickly and easily in the ordinary way. The antrum contained numerous mucopurulent lumps. In manipulating the left antrum, a wool holder with 20 per cent cocain was introduced into the lower nasal fossa on the right side, after which the puncture on that side was performed without difficulty. While this was going on the patient was apparently well, but complained that the anesthesia was considerably less effectual than on the side first punctured. There was then no indication of the cocain intoxication. The pupils were not dilated, and the patient was talking all the time about his case and the troubles consequent on it. When the perforation on the right side had been effected, the injection of air was proceeded with. As the air at first passed through the antrum without resistance, several compressions of the bulb were made in rapid succession, and at last a mucopurulent mass was blown out through the maxillary ostium, which it blocked as it passed through. As a consequence of this the pressure rose in the

antrum and could be distinctly felt in the bulb, which required greater force to compress it than before, in order to remove the lump of secretion from the antrum. At that instant the patient fell prostrate, cyanosed and without respiration. Stimuli and artificial respiration for about half an hour produced no result. Death seemed to have been instantaneous.

There was no opportunity of making a postmortem examination. A wide opening was made, however, in the canine fossa. The antrum was found to be very large and the punctured opening in the usual place, apparently without having detached the surrounding mucous membrane.

The patient was said to have always been a strong, healthy man, one of those mountain dwellers who can bear great physical exertion without ill effects. No further particulars were available.

4. A farmer of 62, with left sided antrum empyema of uncertain duration, was to undergo puncture of the maxillary antrum. This was done through the lower meatus quickly and easily after anesthetizing with a 20 per cent cocain solution. As the man had bronchitis, with sibilant breathing distributed over the dorsal surface, and was also pale and exhausted looking, he was placed, for safety's sake, on a couch before the injection of air was begun. The cocain did not appear to have caused him the slightest inconvenience; and notwithstanding careful observation, no indication of cocain poisoning could be discovered. No dilatation of the pupils. Without any difficulty whatever, the patient walked, with the needle inserted, into the adjoining room and sat down upon the couch. He felt at that time quite well. A careful injection of air immediately showed that the air met with considerable resistance. As soon as the pressure in the antrum was increased, the patient began to complain of difficulty in breathing. He could not get air, was cyanosed, and had a marked feeling of apprehension, cold sweat and uneasiness. He was immediately placed in a horizontal position, and the trocar was removed. Respiration was irregular and shallow, coming in groans, and the face was still cyanosed. The pulse was small, hardly perceptible. In the course of ten minutes the respiratory movements became once more deep and regular, the cyanosis disappeared, and the patient felt

better. Half an hour later he was quite well again, and was able to leave the consulting room without assistance.

This case greatly resembles Claus' case No. 1, where similar symptoms appeared without, however, being followed by serious complications.

In addition to the above four cases, I have collected, in chance conversations with colleagues, three more cases, which I am kindly permitted to describe.

1. Reported by recollection by Dr. Fleischer, Kristiania.

In a young, apparently healthy woman, antrum puncture was to be performed. The needle was introduced through the lower meatus, where the bone was thick and difficult to penetrate. The puncture was performed, however, as usual. During the air injection that followed, the patient sank down unconscious, with stertorous, irregular breathing. The comatose condition continued until death supervened twelve hours later. The postmortem gave no definite explanation.

2. Reported by Professor G. Holmgren, Stockholm.

A woman of 65 was treated for a chronic maxillary sinusitis with slightly fetid secretion. Syringing was performed on several occasions, when, on account of the narrow space and of the patient's sensitiveness, a Lichtwitz needle was employed through the lower meatus. After the introduction of the needle, and before the syringing, air was injected. Immediately after this the patient became deathly pale and pulseless and collapsed. At the same time a peculiar gurgling sound was heard, as of tiny air bubbles. They gave an impression of moving quickly down along the jugular vein. The patient was much exhausted for many hours, but grew better later; and on the next day she had recovered without any ill effects worth mentioning.

3. Reported by Dr. Roll-Hansen, Kristianssand.

The patient was a woman of 34, who, up to that time, had always been well with the one exception that for a rather long time she had been troubled with obstruction of the right half of the nose.

On examination, the right nasal cavity was found to be almost filled with polypi, which appeared to come from the anterior ethmoidal cells. After local anesthesia with cocain (15 per cent), some of the cells were removed in the usual

way and without difficulty. The patient was quite well after the brief treatment. In order to ascertain whether there was also an antrum empyema, a puncture was made under cocain anesthesia, with an ordinary straight cannula, in the usual place below the inferior turbinated bone. There was great difficulty in passing the canula through the bone, on account of the hardness of the latter. As the needle pierced the bone the patient turned rather pale. The perforation was nevertheless completed, and then a careful injection of air was attempted. The air could not be heard to pass out through the ostium maxillare, but at the first pressure on the bulb of the syringe the patient suddenly fell to the floor as though struck by lightning, and lay there at full length, quite unconscious. There was complete rigidity of body and limbs, respiration was rapid and stertorous, and the pulse was also rapid, about 120 (average). The attack lasted five minutes, after which consciousness returned. Tonic rigidity of the trunk and extremities were found, but on the other hand no clonic movements. The color of the patient's face during the attack was paler than her normal, somewhat ruddy complexion. When consciousness returned, she was able, with the nurse's assistance, to walk into the adjoining room, where she was put to bed. For a time immediately after the trauma, the patient suffered from paresis of the right arm. About five hours after the puncture a fresh examination was made. Aphasia was then present. The patient could not find the right words and was unable to recollect even quite ordinary expressions. The pressure of the hand on the right side was rather weaker than on the left. After five days had passed, all the phenomena disappeared, and there was no longer any aphasia. She left the clinic without further trouble of any kind.

The cases that have now been mentioned may together form a very good foundation for a solution of the problems that in this connection present themselves. When we endeavor to ascertain the nature of the factors that have here cooperated we must in the first place keep in mind the fact that from a theoretical point of view the alarming symptoms may just as well have originated in what took place before the operation, namely, in the anesthetizing, as in the operation itself, with the subsequent injection of air and syringing. We will first

consider the cocainization and the part it may be supposed to have played in these cases.

COCAIN POISONING

and its symptomatology are discussed in detail, *inter alia*, in Paulsson's "Lehrbuch der Pharmakologie." The author emphasizes the fact that acute cocain intoxication presents a varying picture. The slighter cases appear as a feeling of languor, giddiness, fear, pallor and indications of syncope, or as excitement, talkativeness, hallucinations and delirium. In more serious cases there is also dilatation of the pupils, dryness of the mucous membranes, vomiting and clouded sensorium. The heart is always affected, with irregular pulse, now rapid, now slow, pale face and the tip of the nose cyanosed, occasional rises of temperature, finally collapse with cessation of circulation and respiration (Cheyne-Stokes). In addition clonic contractions or tetanus, after which death ensues as a consequence of heart and respiration paralysis. After injection of large quantities, e. g., one gramme, death may be instantaneous. It is difficult to say what the lethal dose is. Serious symptoms have been observed after only a few centigrammes, and little or no harm has resulted from a dose many times larger. It may therefore be assumed that individual disposition has something to do with the matter. Cocain in concentrated form is very much more dangerous than in weak solution, as in the first case a considerable portion of the poison is absorbed, while in the diluted form it is to a great extent confined to the place of application and rendered innocuous.

The toxicity of novocain is only from one-sixth to one-eighth that of cocain. Paulsson has experimented upon himself by injecting 0.4 and 0.75 gr. After the first dose no symptoms of poisoning appeared, and after the second only transitory symptoms.

It will from this be apparent that it is only the serious cases of cocain poisoning that can come under consideration in connection with our histories of cases. How large the dose must be to prove fatal in any particular case is not known; but we should at least be able *a priori* to take for granted either that the dose administered must have been

excessive as compared with that ordinarily used, or that these patients must have had an idiosyncrasy for cocain.

If we now consider the doses given, we find, as already mentioned, the following: For anesthesia sometimes novocain adrenalin, and sometimes cocain is employed. Novocain is used by Claus in a 10 per cent solution, of which 6 drops plus 3 drops of adrenalin are placed in the inferior meatus for 20 minutes. That these small doses should be capable of producing poisoning symptoms of the most serious nature is contrary to all our experience in the employment of novocain adrenalin in intranasal operations. By way of comparison it is only necessary to recall Paulsson's experiments, among which 0.4 gr. of novocain were even injected without the slightest effect of poison. Claus himself maintains that it must have been a novocain poisoning, but expresses, it is true, his astonishment that this should twice occur in this particular operation of puncturing and syringing the maxillary sinus, when otherwise, notwithstanding an extensive employment, both clinical and polyclinical, of novocain, he had never seen unpleasant consequences from this anesthetic. Neuenborn has used cocain in a $7\frac{1}{2}$ per cent solution, of which 0.1 gm. is taken up by a thin wool swab which would then contain 0.0075 gm. of cocain. It is stated that with this solution anesthesia is attained only after three applications of the swab. Neuenborn thinks that this minimal dose has produced cocain poisoning in his patients; but he does admit the possibility of the occurrence of a further factor, which he cannot explain, but which he thinks must be sought in the syringing itself.

In the discussion that took place in connection with Neuenborn's statements, it was maintained in many quarters that it could hardly have been cocain poisoning from the application of so weak a solution. Henrici, for instance, who, in the cases reported by him, had employed 10 per cent cocain in careful doses, is emphatic in his opinion that some other factor must have been active.

On my own patients I have used cocain in 10 and 20 per cent solutions. The anesthetization was performed in the following manner: An Uchermann's wool holder was firmly wound round with wool, and saturated first with 10 per cent, and in the final swabbings with 20 per cent cocain, which

was rubbed into the front part of the inferior meatus only at the place where the perforation was to be made. In order to prevent the cocain, when introduced into the narrow nasal passage, from being pressed out of the swab and running back into the nasopharynx, the swab is always squeezed out, and is thus never wet, but only damp. The last swabbings before the perforation is made, are, as I have said, with 20 per cent solution, as experience has convinced me that a solution of that concentration is necessary to obtain sufficient anesthesia, especially where the bone is thick, and where, moreover, there is inflammation in the antrum. Personally I consider even a 20 per cent cocain solution, employed in the above manner, to be quite safe. On all the thousands of occasions on which I have administered cocain, both when acting as assistant physician at our State Hospital and in my private practice, I have never once observed dangerous symptoms of poisoning after 20 per cent applications administered in this manner. Slight intoxications, such as languor, giddiness, etc., may of course have occurred; but these phenomena have always quickly disappeared when the patient has been placed in a horizontal position. To the best of my belief cocain solutions of 20 per cent strength have been used for a number of years in the State Hospital's Otolaryngologic Polyclinic in Christiania without serious consequences ever having been observed. Moreover in the cases in question only a relatively small part of mucous membrane was anesthetized. If a 10 to 20 per cent cocain solution, employed as indicated above, were attended with danger, it seems remarkable that the unpleasant consequences did not first of all appear in one of the intranasal operations, where the cocainized region was of far greater extent than the case here. It is possible that among the cases described in the literature on the subject there have been some individual instances of intolerance, although this explanation does not seem especially obvious, considering that most of the patients had been anesthetized several times before the fatal puncturing (Claus', Neuenborn's and Henrici's cases). Of my patients, No. 1 was treated with cocain adrenalin every other day for two or three weeks without the slightest ill effects. In the case of No. 2 a series of cocain administrations with a 20 per cent solution was subsequently given

for another nasal affection, without occasioning the slightest inconvenience to the patient.

A perusal of the history of the cases shows, moreover, that these attacks have not followed directly upon the anesthetizing. In none of my patients could any sign of poisoning be discovered after the cocainization. Nor does the little shock which so often accompanies the perforation of the antrum wall appear to have been of any importance; on the contrary, the patients stated, after the perforation, that they felt quite well. It was not until the injection of air or the syringing was performed that the alarming phenomena appeared. If it was an effect of cocain that here asserted itself, it is very remarkable that without any premonitory symptoms whatever, it should appear in apoplectic form, in immediate connection with the introduction of air or of water into the antrum.

There is on the whole so much here that speaks against the theory of cocain poisoning that it is impossible to feel entirely satisfied with this diagnosis. The anesthetization may be a predisposing factor, but scarcely the decisive one. There must be, as Henrici says, some other factor that is cooperative. We ought therefore first of all to see whether an explanation of these mysterious phenomena cannot be found in the operation itself and the consequent injection of air into, and syringing of, the antrum. We have here only two possibilities to consider. There must either be, as several writers have indicated, a reflex of an unknown nature from the mucous membrane of the antrum, or the operation must have produced an air embolus.

I will first mention the points that favor the former of these possibilities, the reflex theory. Before describing the investigations connected with it, it will be as well to give a general survey of the reflexes originating in the nasal mucous membrane itself.

THE NASAL REFLEX NEUROSES.

The nasal reflexes, or reflex neuroses, are well known and have been much discussed, particularly in the special literature of the eighties and nineties of the last century, while the antrum reflex still remains a *terra incognita*. As, however, the mucous membranes of the maxillary antrum and of the

nasal cavity are innervated by the same nerve trunks, it is obvious that all the reflexes from the mucous membranes of the nose and of the antrum should be viewed from the same visual angle and all treated alike as nasal reflex neuroses.

It has long been known among rhinologists that a number of diseases occurring especially in paroxysms have been affected by intranasal treatment of the pathologic changes in the mucous membrane of the nose. Voltolini was the first to emphasize the connection that there appears to be between various asthmatic conditions and nasal polypi. As the asthmatic attacks became less severe after the removal of the polypi, it was his opinion that the latter were the cause of the asthma, and he came to the conclusion that "either the polypi reflexly produced the asthma, or these new formations, in obstructing respiration, altered its chemical processes and thereby the structure of the lung tissue."

Voltolini's work, however, aroused no special attention. It was Fraenkel who first of all caused the nasal reflex neuroses to become a much discussed subject in the special literature of the eighties of the last century. Fraenkel, in his well written work, "Ueber die Zusammenhang von Asthma nervosa und Krankheiten der Nase," maintained that asthma with nasal polypi must be regarded as a reflex spasm localized in the bronchi muscles, called forth by an irritation of the sensory nasal nerves. In response to Fraenkel's work, contributions poured into the medical journals from all sides. At first the discussion had special reference to bronchial asthma and its relation to intranasal pathologic changes of various kinds. It was not long, however, before the field of nasal reflex neuroses was extended to other subjects. Hack and his pupils, among them Fliess, led the way. One group of diseases after another was said to have its origin in pathologic changes in the nasal mucous membrane—migraine, supra-orbital neuralgia, vasomotor disturbances of the vessels of the skin, epilepsy, amaurosis, articular rheumatism, Basedow's disease, diabetes, diseases of the heart and stomach, dysmenorrhea, etc., ad infinitum. Everything was due more or less to nasal reflex neuroses, which at last seem likely to become the inexhaustible source of all evil.

As a matter of course, all these articles on the subject of

healing diseases of the most varied character by galvanocautery or other intranasal treatment, made a great sensation, and criticism was not long in making itself heard. The exaggerations were sharply attacked, and the enthusiasts who had gone to extremes were unable, in the long run, to maintain their position. There was a great rebound, and skepticism even went so far as to deny altogether the existence of reflex neuroses. A detailed account of the numerous contributions of the eighties and nineties of the last century would here carry us too far, for they occupy too much space in the special literature. The contention about the nasal reflex neuroses has been of great importance from the fact that it has drawn attention to the by no means insignificant part played by the nasal mucous membrane and its reflexes in pathology. A brief account of the present view held by rhinologists as expressed, *inter alia*, by Jurasz, will therefore have a certain amount of interest.

Furnished with an abundance of sensory and easily irritated nerves, the nasal organ performs, by means of reflexes, a number of its most important tasks in respiration. The reflexes are produced and regulated by physiologic irritation, the consequence being that before it reaches the lungs the air inspired is warmed, supplied with moisture, and freed from injurious pollution. The nasal organ further represents a protective apparatus for the organism, guarding it, by means of its reflex operations, sneezing, coughing, spasm of the glottis, and cessation of respiration, against gases that are injurious and dangerous for the body. This reflex mechanism, whose operations are of an entirely physiologic nature, may also, however, through the numerous connections between the nasal organ and other parts of the body, produce morbid results, if the nasal mucous membrane for some reason or other becomes abnormally sensitive. It is then no longer the normal physiologic reflex with which we have to do, but the pathologic reflex action, the reflex neurosis. Notwithstanding that the mucous membrane of the nose is continually exposed to injurious influences of various kinds, and in consequence is frequently the subject of pathologic changes, it nevertheless appears that reflex disturbances are comparatively rare. It has been supposed that on account of the resistance of the

nerves to the pathologic irritant, the local changes are not as a rule capable of exerting the necessary stimulus. If, on the other hand, in consequence of local or general nerve weakness, there is also an increased irritability, this favors the transfer of the stimulus to the reflex paths. Thus in addition to the local irritant, another important etiologic factor is required, namely, the increased irritability of the reflex mechanism. The excessive irritability may appear either as a local disturbance or as part of a general neurosis. Sensory stimuli, which are capable of starting reflex neuroses, originate most frequently in the nasal mucous membrane itself. Practically all diseases or abnormalities of the nasal and subordinate cavities, however, will come under consideration here, as every pathologic process is capable of irritating the sensitive nerves, so that reflex phenomena may be produced in cases where the other conditions are also present.

Reflexes are set up most frequently by mechanical irritation of one kind or another. Hopmann attaches special importance to the transitory swelling of polypi and hypertrophic parts of the turbinated bones, particularly if moreover the nasal lumen is contracted as a result of septum deviation, ridges or spurs. Kjelman has reported two cases in which he believes that epileptiform attacks have been caused by changes in the nasal mucous membrane. The same writer found in the special literature 15 instances in which epileptiform attacks are said to have diminished after intranasal treatment. He also considers as chief causes polypi and hypertrophic turbinated bones, especially swollen lower turbinated bones. Tumors that quite fill the nasal cavity seldom give rise to nasal reflexes. Corpuscular elements, such as dust, smoke and vegetable substances, and in some cases the scent of flowers of various kinds, also play a part. In addition to the nature of the irritant, there is also significance in the power with which it acts. In hyperesthetic patients, however, a minimal irritation will suffice to set up the reflex. It is an interesting fact that cases of atrophic rhinitis, unlike those of hypertrophic catarrh of the mucous membrane, are rarely complicated with reflex neuroses, probably because it is accompanied by degeneration of the nerve fibers.

Traumatic lesions, especially after intranasal operations,

also have some significance. Thus Rethi reported cases in which spasm of the glottis and supraorbital neuralgia supervened after cauterization and snaring operations. Aronson observed asthmatic attacks after galvanocauterization of nasal polypi. In the literature on the subject, moreover, it is now and again stated that fits of unconsciousness, accompanied by spasms in the upper and lower extremities, can be produced from the nasal mucous membrane. Several of these writings are from an earlier period, before cocaine was employed as an anesthetic.

The nasal reflex neuroses originate in the same way as all other reflexes through an irritation of the centripetal nerve fibers in the nasal cavity, i. e., of the first and second branches of the trigeminal or of the olfactory nerve. A few authors have indicated certain zones in the nasal cavity which were said to be especially susceptible to irritation. Hack has pointed out, for instance, as excessively sensitive spots, the anterior part of the lower and middle turbinated bones, while other rhinologists consider the dorsally situated part of the septum as such. In some quarters it is maintained that certain reflex phenomena have certain zones of irritation. Torstenssen, for instance, held that in 400 cases of asthma examined, he had found the place of irritation localized to the upper part of the septum. The present view, which is based upon clinical and experimental investigations, is generally that any spot on the nasal mucous membrane may serve as the point of origin of reflex neuroses. In this connection it should be mentioned that so renowned a scientist as Killian holds a different view. With his "Normalfadensonde" he has found that the irritation is not felt equally strongly in all places. The most marked sensitiveness is found in the anterior part of the nasal cavity on the tubercles of the septum and on the anterior part of the inferior turbinated bones. The posterior sections of the turbinated bones and the septum are as a rule less sensitive. As a result of numerous investigations, Killian, in company with other writers, points out that the respiratory mucous membrane with normal sensibility does not give rise to reflex neurosis. Certain predisposing conditions are necessary for this; and only when they are present can the neurosis appear.

Instead of classifying the reflex neuroses on an etiologic basis, the grouping, Killian maintains, ought to be carried out on an anatomic and physiologic basis. In the respiratory field, for instance, he distinguishes between an anterior zone that is innervated from the first branch of the trigeminal, through the anterior ethmoidal nerve, and a posterior zone, supplied from the second branch of the trigeminal, through the posterior, superior and inferior nasal branches coming from the sphenopalatine ganglion. With regard to these two parts, the ethmoidal and the sphenoidal, the cases are not similar. Killian therefore divides the reflex neuroses into two groups, the anterior or ethmoidal, and the posterior or sphenoidal neuroses. The ethmoidal neuroses are the more frequent, as the anterior portion of the nasal mucous membrane is especially exposed to irritants. As a consequence of this, hyperesthesia will be most easily developed here, particularly in the previously mentioned four more sensitive places. Three degrees of the reflex action may be distinguished, (1) the local, which is confined to the region of the nasal cavity itself, (2) the regional, which may also appear in other parts of the trigeminal field, and (3) the widespread reflexes, which encroach upon other nerve areas. The local and regional reflex phenomena make their appearance within the area of the first branch of the trigeminal and especially in the region of the ethmoidal nerves. In irritable conditions of the ethmoidal part of the nasal mucous membrane therefore, itching is observed not only at the irritated spot, but also in the inner canthus, in the median part of the eyelid, in the caruncula lachrymalis, and in the conjunctiva, without these parts themselves being hyperesthetic. The conjunctiva bulbi can be seen to be hyperemic with increased secretion. Even photophobia may occur from intense irritation of the long ciliary nerves. There is also hyperemia of the skin and the ala of the nose, and not infrequently a feeling of weight is experienced in the region of the forehead, with pain in the frontal sinuses (ethmoidal nerve). In addition to these symptoms, Killian states further that distant phenomena in the form of "nasal cough" and nasal asthma in connection with vasomotor rhinitis and hay fever, may occur as a consequence of the ethmoidal irritation. The sneeze reflex is also an ordinary reflex phenome-

non in these conditions of irritation. The anterior ethmoidal nerve has been indicated by Sandmann as the most important "sneeze nerve."

With regard to the sphenoidal neurosis, too, the anatomic conditions must be kept clearly in view. The dorsally situated parts of the nasal cavity and adjacent parts of the pharynx are furnished, as we know, with sensory nerves from the sphenopalatine ganglion. The relation of the nerves to the sphenopalatine ganglion is important. Some of the nerve fibres pass through the ganglion while others go past it. In both cases, however, ganglion fibers are taken up. The ganglion itself must be regarded, according to von Lenhossek's investigations, as a sympathetic ganglion. It is in direct communication, through the deep petrosal nerve, with the sympathetic plexus round the internal carotid. Nerve branches from its multipolar nerve cells follow the sensory nerves to the mucous membrane over the middle and lower turbinated bones and the septum, and end among the epithelial cells of the mucous membrane. As a consequence of this, irritants that attack these parts must, in Killian's opinion, irritate the sympathetic terminal fibres as well as the trigeminus, and thereby produce reflexes that are quite beyond our knowledge. According to Killian, the reflex phenomena produced from the sphenoidal zone are similar in quality to the ethmoidal reflexes.

It will be of special interest to find out the relation of the nasal reflexes to respiration and the action of the heart. We should expect, not least in the case of respiration, to find reflex irritation phenomena, as the centripetal nasal nerves in the service of respiration may be assumed to exert a great influence on the respiratory center. Several writers have subjected this question to a careful examination, and have made series of animal experiments in order to find out how intranasal irritation can influence respiration and heart action.

As early as 1870, Kratschmer had experimented on curarized rabbits. As irritants he employed various kinds of gas and, more especially, tobacco smoke. He arrived at the following results.

In the animal's organism there is a peculiar reflex connection between the nasal mucous membrane on the one hand and respiration and circulation on the other. The sensory paths

of this reflex connection are situated in the trigeminus, the motor paths in those nerves which supply the respiratory muscles and in the vagus. The reflex appears with any irritation of the nasal mucous membrane, especially with that which is produced by various kinds of gas and always manifests itself in an expiration tetanus with expiratory cessation of respiration, accompanied by a closing of the glottis and by slow heart action and increasing pressure of blood in the arteries.

Kratschmer has also made numerous comparative experiments with isolated irritation of the larynx, trachea and lungs. He considers that the reflex from these organs is of no great importance. The above mentioned reflex symptoms are produced from the mucous membrane of the nose and not from the organs below. Reflexes can of course also be started from the larynx, but they behave in a manner different from that described above. The nasal reflexes are set up notwithstanding intracranial section of the olfactory nerve, but do not appear after destruction of the trigeminal. The author considers he has thereby proved that it is the trigeminal that represents the sensory part of the reflex arc. The motor paths are situated as regards respiration in those nerves which supply the respiratory muscles and as regards the heart in the vagus. It is an interesting fact that by electrical irritation of the intraorbital branch of the trigeminal, Kratschmer produces an expiratory cessation of respiration; but this differs from the cessation occasioned by intranasal irritation, in that by the action of the irritant a deep inspiration always occurs first, followed now and then by small, shallow respiratory movements. Electric irritation, moreover, has no effect upon the heartbeats.

Langendorff, too, found that interruptions of respiration came with irritation of the infraorbital branch of the trigeminal, with slight irritation increased breathing activity or cessation in inspiration phase, with stronger irritation expiratory cessation of respiration.

Besides Kratschmer and Langendorff, Holmgren, among others, showed in 1883 that cessation of respiration can be brought about by irritation of the nasal terminal fibres of the trigeminal, and that it is reflex trigeminal action which, for

instance, causes respiration to cease in a rabbit that is held under water (Rosenthal-Falk's experiments).

Knoll, who carried out his experiments on unnarcotized rabbits, found, on the application of strong electric irritation to the infraorbital nerve, that there was an expiratory decrease in the frequency of respiration and finally complete cessation in the expiratory phase. A similar effect has also been found by strong pressure on the skin over the infraorbital region. Knoll maintains the view that not only must a connection be assumed between the sensory paths and the respiratory centre, but that there must probably also be a direct connection between the sensory nerves and the spinal centers which supply the respiratory muscles with motor fibers. If this were not the case, it would be difficult to establish the fact that in an animal in which spontaneous respiration ceased with the section of the spinal cord, a single deep inspiration could be called forth by strong electric stimulation of sensory nerves. Irritation of these sensory paths can presumably cause a direct irritation, not only of the respiratory center itself, but also of the spinal centers for the respiratory muscles. This interference of irritants issuing partly from the respiratory center, partly from the spinal centers concerned, may explain the numerous combinations of increased respiratory frequency and depression of the diaphragm found in animal experiments, where now the one, now the other type of respiration prevails. The respiratory center situated in the medulla oblongata, whose rhythmic action is kept up by the constant flow of blood to it, can on the one hand be excited by psychic or sensory stimulants, and on the other hand be inhibited through the influence of certain nerve tracts, e. g. vagus and trigeminus. The impulses that issue from the respiratory center are transmitted to the respiratory center in the spinal cord. It is probable, however, that the respiratory center may also be exposed to irritation directly from the cerebrum, as the respiratory muscles can, as we know, be voluntarily set in activity.

Sandmann has on the whole come to the same conclusion as Kratschmer; but he found that with slight irritation of the nasal mucous membrane, it was not exactly an expiratory tetanus that occurred, but a cessation of breathing in the

phase at which it had arrived at the moment when the irritation took place. (Reported from Schmiegelow.)

Sandmann has further carried out experimental investigations with animals, for the purpose of a more minute study of the physiology of the bronchial muscles. He came to the conclusion, *inter alia*, that an irritation of the nasal mucous membrane in noncurarized animals caused, in addition to expiratory cessation of respiration, a narrowing of the air passages by contraction of the bronchial muscles. In this way the protection of the respiratory organ against injurious influences is increased and at the same time the removal of mucus from alveoli and bronchi is greatly facilitated. By contraction of the ring of smooth muscular fibre with which, according to Kölliker, the entrance to the alveoli is surrounded, the mucus will be detached and will thus be more easily removed from the infundibulum. This author asserts that by his experiments on animals he has supplied a physiologic basis for the nasal asthma so frequently described in clinical reports. Brodie and Dickson also claim to have proved contraction of the bronchial muscles after intranasal irritation upwards and backwards from the septum. Several other writers express themselves in the same way. Lazarus, who, in his experiments on animals, used curarized rabbits, has employed electric and mechanical (flicking) irritation of the posterior part of the septum and the lower turbinated. He gives the following as the positive result of his experiments. Certain irritants of the nasal mucous membrane reduce reflexly the lumen of the bronchi. The centrifugal part of the reflex arc is to be sought in the vagus, as, after the section of this nerve no effect is obtained, while the increase of pressure in the bronchi again occurs on irritation of the peripheral end of the vagus. The diminution of the bronchi is in all probability due to contraction of the bronchial muscles. Independently of Lazarus, a somewhat similar conclusion is arrived at by Francois-Frank.

According to Killian, Grossmann has also shown, by experiments on curarized, artificially breathing animals, that electric and mechanical irritation of the nasal turbinated bones in the region innervated by the second branch of the trigeminal causes considerable functional disturbance both of the heart action and of the respiration. There occurred, for instance,

stasis in the pulmonic circulation, increase of the intrathoracic pressure and depression of the diaphragm. The reflexes are supposed to go from the sensory nasal nerves to the central nervous system and thence through the vagi to the heart and lungs and through the phrenic nerves to the respiratory muscles. In noncurarized, spontaneously breathing animals, the irritation caused labored inspiration, which almost led to complete suspension of respiration. The same thing occurred with section of the two vagi. Grossmann therefore thinks, with Koblanck and Röder, that the reflex must have taken another direction, which Killian believes will be found in the sympathetic system. Möllgaard, in 1910, made minute investigations of the respiratory nervous system in vertebrate animals. He confirms the view held in accordance with physiologic research, that the vagus carries bronchomotor nerves to the lung, but at the same time points out that these are of a sympathetic character, as they are interrupted in the ganglion nodosum.

Upon the basis of the above investigations and others which will not be described at length in this brief survey of the literature, it has been thought that the influence of some of the nasal reflex neuroses upon the respiratory organ may be explained in the following manner, namely, that the centrifugal paths which are irritated through the respiratory center will be found in the spinal accessory for the spasm of the glottis, in the spinal nerves of the expiratory muscles for attacks of sneezing and coughing and in the vagus for asthma. There are still many circumstances, however, that are not explained, this being especially the case with regard to asthma. This disease is indeed generally looked upon as a neurosis due to a spasm either of the bronchial muscles or of the diaphragm. Several writers maintain, however, that the asthmatic attacks are due in the first place to a vasomotor disturbance, a vascular dilatation, or a vascular contraction. The general idea, however, as already indicated, is to emphasize the reflex nature of asthma, to regard it as a neurosis originating in sensory irritation of various organs, among them, very frequently, the nose, whether the centrifugal paths are to be found in the vagus, the phrenic or the sympathetic.

The great number of nervous disturbances in the various organs, phenomena which more or less justifiably have been looked upon as nasal reflex neuroses, will not here be described at length. As regards most of these diseases, e. g. Basedow's disease, epilepsy, muscular cramp, neuralgia, migraine, etc., it cannot, according to Jurasz, be proved with certainty that they stand in a reflex connection with pathologic changes in the nasal mucous membrane. There will be special difficulty in deciding what neuroses originate in the nasal mucous membrane, and yet show their result in other organs. It will be clear that the diagnosis in these cases may present great difficulties when it is to be proved that the disease really has originated through irritation of the nasal mucous membrane and in no other way. As Jurasz has pointed out, the physiologic and pathologic experimental investigations that we know of at present, do not yet form a sufficient foundation for a judgment of the clinical phenomena. We cannot therefore disregard the possibility of the influence of other etiologic factors. It must be remembered that the presence of a nasal affection does not by any means prove that a reflex neurosis of simultaneous occurrence is of nasal origin. Even if an attack answering to the neurosis can be produced by instrumental irritation of the nasal irritation zones, the character of the neurosis is not thereby proved.

In an epileptic, for instance, an irritation of the nasal mucous membrane may start an attack. The irritability in such a patient, however, is increased throughout the sensory sphere of the nervous system, and of course not least in the nasal mucous membrane, which also under normal conditions is easily irritated. Even if in this case there are intranasal changes it is by no means impossible that the epileptoid attacks may be started from some other place. On the other hand it will always be significant if a neuralgia or an asthma is favorably affected by intranasal cocainizing. Here, too, however, it must be borne in mind that locally soothing medicaments like cocain may show a transitory favorable effect, even if the neurosis does not originate in the nasal mucous membrane. The fact that the phenomena disappear after intranasal treatment has been emphasized by many writers as a proof of the nasal origin of the neurosis. This proof, however, is not

decisive either; for if the nerve centers are under one kind of irritation, a new irritant may be able to reduce or quite remove this state of irritation (Goltz). Thus the disappearance of sciatica has been observed after cauterization of the lobe of the ear, and the cessation of hysterical attacks after cauterization of the clitoris; but no one would on that account think of connecting these organs directly with the nervous phenomena. It will not always do, therefore, to look upon those nervous disturbances which disappear, for instance, after an intranasal galvanocauterization as nasal neuroses.

Suggestion, too, of which the great importance to the functional neuroses is generally recognized, has also undoubtedly played a great part here. This has especially been the case during that period in which a large number of ailments were said to be curable by means of galvanocauterization of the nasal mucous membrane. Jurasz recalls the constant relapses that take place as soon as the effect of the suggestion has passed away. The treatment is therefore not a decisive proof. There are numerous factors moreover that must be taken into account, such as mechanical conditions, disturbances of circulation, etc., which assert themselves in connection with the treatment given. In general a critical judgment of the symptoms in each case will be necessary in order to avoid being thrown quite off the scent.

From this account of the nasal reflex neuroses it will be seen that it is first of all those reflexes which originate in the nasal mucous membrane itself that have been carefully investigated. On the other hand we have little knowledge of the reflex effect that may possibly come from the antrum mucous membrane. Our literature on the subject does, indeed, give accounts of some cases in which the antrum reflex is supposed to have played a part; but these depend only upon suppositions which as yet lack the necessary experimental physiologic basis. If, however, an attempt is to be made to find an explanation of the symptoms which were observed by me and others in connection with antrum puncture and subsequent injection of air or syringing, this basis must be furnished. The laborious road through animal experiments must be trodden; and if the experiments by irritation of the mucous membrane of the antrum succeed in producing phenomena

similar to those described in the histories of cases, the problem will have been brought nearer to its solution.

An account will be given in the following pages of a series of experiments on animals and their results.

THE EXPERIMENTS ON ANIMALS.

These were carried out on rabbits, as the rabbit has a comparatively well developed maxillary antrum. It appears generally as an irregular cavity about 1.5 to 2 cm. long, 1 to 1.5 cm. high and from 0.5 to 0.6 cm. wide, which aerates the greater part of the maxilla. The antrum is bounded behind by the orbit and the ethmoturbinate bones and is connected with the nasal cavity by an oval opening from 1 to 2 cm. and about 1 mm. wide, situated at the back of the middle nasal fossa, between the maxillo- and nasoturbinal.

As a rule Belgian rabbits were used, of from 2,500 to 3,000 gm. weight. It was found that the use of smaller animals was impractical, as the small space in their antrum made the experiments difficult. The mode of procedure was as follows. The animal was narcotized in the first experiments with ether, subsequently with subcutaneous injections of urethan in doses of 1 gram of urethan per kilogram of body weight. The narcosis that supervened in the course of from 5 to 10 minutes was considerably quieter after this mode of procedure than after the ether narcosis and was borne well. As soon as the animal was narcotized the carotid on both sides was prepared and laid bare for about 1 centimetre, after which a carotid canula was inserted for the registration of the heart action and the blood pressure. For the measurement and registration of the blood pressure a membrane manometer of the Frank type was employed, its movements being calibrated by the aid of a quicksilver manometer. The respiratory movements were also transferred to the registering apparatus by the aid of a pelotte which was fixed by means of an elastic bandage to the animal's abdomen in the region of the diaphragm. In this way exact control of the pulse and respiration was kept and at the same time the blood pressure could be read at any time during the experiment.

It will be remembered from the cases described that the alarming phenomena in the patients did not appear until after

the puncture had been made and in most of the cases in connection with the subsequent injection of air. It was therefore obvious that the same method of procedure should be employed with the animals experimented on, namely, first to puncture the antrum and then see what effect the injection of air would have.

The puncturing of the antrum was performed in the following manner. After the soft parts and the periosteum had been pushed aside, the bony walls in the upper part of the maxillary sinus about 7 mm. below the orbital margin and about 3 to 5 cm. laterally from the median line were perforated with a specially constructed blunt perforator, without injuring the mucous membrane within. After the bone had been perforated in this way, the mucous membrane was pierced with a sharp paracentesis needle, or opened with a fine galvanocautery. A short canula was then inserted, which only just projected into the lumen of the sinus, and which exactly fitted the opening, thus being firmly fixed in the bony wall. For the injection compressed gas was used from cylinders with a regulating valve. With this experimental arrangement the air passed without difficulty into the antrum and out through the ostium maxillare. The injection was done with a pressure of about one atmosphere. It must be remembered, however, that on account of the escape of the air through the maxillary ostium while being injected the pressure in the antrum itself is considerably less than one atmosphere. In order to ascertain this, the following experiment was made: In one of the animals experimented on, two trephine openings were made on the same side. One of these openings was connected with a mercury manometer, and the other with the compressed air receptacle. It proved that the pressure in the cavity did not exceed 200 mm. Hg. By way of comparison it may be stated that the pressure in the antrum in a human being during forced expiration through one-half of the nose may rise to about 120 mm. Hg. If the antrum, through an opening in the alveolus, is connected with a mercury manometer, this can be easily ascertained.

At first the animals were not tracheotomized. It appeared, however, that the pressure of the air through the ostium maxillare was also transmitted down through the trachea. In

subsequent experiments, therefore, a closed canula, airtight towards the cavity of the mouth, was inserted in the trachea, so that all passage of air to the lungs was impossible.

Several of the earlier experiments with animals must be left out of consideration on account of one particular defect in the experiment arrangements, which will be mentioned more fully later on. Only those experiments that were considered to be quite perfect will be mentioned here.

Experiment No. 1.

Rabbit's weight 2,500 grams.

Urethan narcosis with subcutaneous injection of 2 grams. urethan. Antrum canula in left maxillary sinus. Blood pressure at beginning of experiment 99 mm. Hg. Frequency of respiration 24 per minute. Strong and regular respiratory movements. Air was introduced into the antrum 19 times under a pressure of one atmosphere. In the first seven injections, the animal was not tracheotomized.

1. Injection of air during 7 sec. Irregular and superficial respiration and trifling lowering of blood pressure. Pause of 40 sec. Normal respiration and blood pressure of 99 mm. Hg.

2. Injection of air during 7 sec. Cessation of respiration in inspiration phase with two small irregular respiratory movements. Distinct lowering of blood pressure. Pause of 2 min. Regular respiration and blood pressure of 99 mm. Hg.

3. Injection of air during 14 sec. Complete cessation of respiration and lowering of blood pressure for corresponding period of time. A single respiratory movement during the injection was accompanied by a rise in the blood pressure. Pause of 24 sec. Respiration strong, although somewhat slower than before, four in 10 sec.

4-8. Injection of air during four short periods with corresponding irregular, suspended respiration and lowering of blood pressure. Every lowering of blood pressure was followed by a rise as soon as the current of air ceased to flow. Pause of 3 to 4 min. during which tracheotomy was performed and a closed trachea canula inserted. The respiration, which before the tracheotomy was as strong and regular as at the beginning of the experiment, after the opening of the trachea became somewhat irregular and rapid, six in 10 sec.

9. Injection of air during 15 sec. Three small, irregular respiratory movements followed by 10 sec. expiratory cessation of respiration. Pause of 65 sec. Respiration strong, at first somewhat slow, but during the latter part of the pause of normal frequency, five in 10 sec.

11. Injection of air during 10 sec. Absolute expiratory cessation of respiration for 8 sec. and then one shallow respiratory movement. Pause of 25 sec. Strong, regular respiration.

12. Injection of air during 20 sec. Shallow respiration, but no cessation. Pause of 30 sec. Strong, quiet respiration.

13. Injection of air during 15 sec. Shallow, somewhat slow respiration, but no cessation. Pause of 40 sec. Respiration strong and quiet.

14. Injection of air during 16 sec. Expiratory cessation of respiration, and three slow, shallow respiratory movements. Pause of 32 sec. Quiet, strong respiration.

15 to 18. Injection of air during four successive periods, each of 3 seconds' duration, with corresponding irregular, shallow respiration. Pause of 23 sec. Strong, quiet respiration.

19. Injection of air during 7 sec. Four slight, irregular respiratory movements. Pause of 56 sec. Quiet, strong respiration.

20. Injection of air during 15 sec. Respiratory movements somewhat shallow, with decreasing frequency, four instead of six in 10 seconds.

The canula was finally transferred to the trephine opening in the right antrum, where the perforation of the bone had caused bleeding from the mucous membrane. As soon as the pressure was applied, general spasms ensued and death.

The body was dissected immediately after death had taken place. After all the trunk vessels from and to the heart had been ligatured, the heart was first examined. It then appeared that air bubbles were visible through the wall in the right antrum and ventricle. The heart was opened under water in order that the air bubbles might be more easily seen. The right auricle and ventricle were found full of air bubbles and frothy blood, while on the other hand no air was to be found in the left half of the heart. The cranium was then opened

and the cerebral matter examined under water. No air bubbles could be discovered. In the other organs there was nothing special to be noticed.

In this experiment a comparison of the respiration and pulse curves before and after tracheotomy is of particular interest. The respiratory movements, especially during the first half minute after the opening of the trachea, are irregular and shallower than before tracheotomy. It is not long, however, before the animal adapts itself to the new conditions, and the breathing once more becomes regular and strong, although the summits in the respective curves are not so high as during the first part of the experiment. It is further noticeable how different is the effect of the injection of air into the antrum before and after the opening of the trachea. Before tracheotomy the cessation of respiration occurs in the inspiration phase, accompanied every time by a marked lowering of the blood pressure. After tracheotomy there is also, it is true, cessation of respiration, but of quite a different character. It is then really an expiratory cessation of respiration, and this is not accompanied by a lowering of the blood pressure. The blood pressure remains throughout at from 95 to 100 mm. Hg., quite independently of the effect of the air on the antrum.

How then are the cessation of respiration and lowering of blood pressure in the non-tracheotomized animal to be explained? In order to find out, the following experiment was made. A T-canula was placed in the trachea and connected with a water-manometer. It then appeared that the pressure of the air in the trachea, which, during quiet respiration, answered to 2 to 3 cm. water, rose, during the injection of air into the antrum with a pressure of one atmosphere, to from 12 to 14 cm. water. There is thus an increase of pressure of about 10 cm. water, a pressure that is sufficiently great to inflate the lung alveoli in the rabbit, so that a cessation of respiration ensues. The inflation of the lung alveoli with the consequent compression of their blood vessels will be followed by an immediate lowering of blood pressure. In order to test the correctness of this experiment, a closed bent canula was inserted above the T-canula, and through it air was injected with constantly increasing force, until cessation of respiration and lowering of blood pressure occurred. The smallest air

pressure required to obtain this result answered to from 10 to 12 cm. water, a pressure that was read off in the first experiment. It will be seen from these two experiments that the current of air through the ostium maxillare does not only move forwards out through the nostrils, but also backwards down through the trachea, and that the pressure of air here is sufficiently great to cause a cessation of respiration. In all the subsequent experiments with injection of air, therefore, the animals were tracheotomized with closed canula.

Even after tracheotomy was performed, however, it appeared that every injection of air into the antrum distinctly affected the respiration. Four out of the twelve antrum injections with closed tracheal cannula caused absolute expiratory cessation of respiration. The eight other injections were not, it is true, followed by absolute cessation of respiration, but the effect on the breathing was nevertheless marked. It was shown that the respiratory movements with the last three injections of air, although they do not cease, are yet undoubtedly affected. They become irregular and shallow.

Experiment No. 2.

Rabbit's weight 3,000 grams.

Urethan narcosis by subcutaneous injection of 3 grams urethan. Tracheotomy with closed tracheal canula. The antrum canula in left maxillary sinus. Blood pressure 96 mm. Hg. Respiratory frequency 30 per minute. Respiratory movements regular and strong. Air was introduced 10 times into the maxillary sinus with a pressure of one atmosphere and gave the following results.

1. Injection of air during 10 sec. Slow, shallow respiratory movements. Pause of 15 sec. Respiration considerably stronger.

2. Injection of air during 8 sec. Absolute expiratory cessation of respiration for the same period. The cessation of respiration terminated with a convulsive respiratory movement. Pause of 42 sec. Quiet, strong, but rather slow respiration.

3. Injection of air during 10 sec. Absolute expiratory cessation of respiration for that period, followed by two convulsive respiratory movements. Pause of 20 sec. Strong, quiet, but somewhat slow respiration.

4. Injection of air during 30 secs. Absolute expiratory cessation of respiration for 13 sec., and then one convulsive and three irregular respiratory movements followed by 10 sec. of absolute expiratory cessation of respiration. Pause of 16 sec. Strong, somewhat slow respiration.

5. Injection of air during 19 sec. A convulsive respiratory movements. Pause of 10 sec. Strong, quiet respiratory movement the instant the pressure was applied, and then shallow respiratory movements. Pause of 64 sec. Respiration during the first part of the pause somewhat irregular, but gradually becoming strong and regular.

6. Injection of air during 18 sec. One convulsive respiratory movement followed by feeble, irregular respiration. Pause of 62 sec. Strong, regular respiration.

7. Injection of air during 12 sec. Absolute expiratory cessation of respiration for 5 sec., followed by shallow respiratory movements. Pause of 10 sec. Strong, quiet respiration.

8. Injection of air during 10 sec. Absolute cessation of respiration during that period. Pause of 60 sec. Respiration irregular and somewhat suspended.

9. Injection of air during 10 sec. Absolute expiratory cessation of respiration during that period. Pause of 60 sec. Respiration somewhat irregular and suspended.

10. Injection of air during 12 sec. Absolute expiratory cessation of respiration during that period, followed by several convulsive respiratory movements. Pause of 3 min. Bad, irregular respiration. Several intervals with entire cessation of respiration. In the latter part of the pause, however, the condition somewhat improved, the respiratory movements becoming more regular although weaker than before. The canula was now transferred to the other side, where a little bleeding had occurred during the trephining, in consequence of lesion and possible detachment of the antrum mucous membrane. Air emboli were therefore to be expected here, and the instant the current of air was turned on, respiratory spasms did occur with general clonic movements in the muscles of the face and extremities, and the animal died in the course of a few seconds. Autopsy showed the same results as

in the first animal experiment, namely, air bubbles and frothy blood in the right antrum and ventricle, but on the other hand air was not visible in the left half of the heart.

A complete survey of the experiment shows the following results. The animal was of sound constitution, with strong, regular respiration and relatively high blood pressure, 96 mm. Hg. Each injection of air is shown in the curve. As a rule, in seven out of ten cases, absolute expiratory cessation of respiration was caused, lasting, in most instances, as long as the pressure in the antrum was kept up, and being finally succeeded by one or two convulsive respiratory movements, or the respiratory movements continue unchanged, quiet and regular, as soon as the pressure ceased. Three times there was no cessation of respiration. As the pressure was applied, a single convulsive respiration was observed, followed by one or more shallow respiratory movements, after which although the irritant continued to act, the respiration went on quietly without being further affected.

While thus the injection of air exerted an undoubted influence on the respiration, it does not appear to have the slightest effect on the action of the heart. The pulse curve remains throughout quite unchanged. This is also the case with the blood pressure, which was measured at about 95 mm. Hg. as long as the experiment lasted.

Experiment No. 3.

Weight of rabbit 2,500 grams.

Urethan narcosis with subcutaneous injection of 2 grams. urethan. Tracheotomy with closed canula. General condition of the animal good, with respiratory frequency of 48 per minute, and blood pressure of 100 to 110. The pulse curves, during the greater part of this experiment, could not unfortunately be registered, as the blood in the right carotid, notwithstanding every precaution, repeatedly coagulated.

1. Injection of air during 14 sec. One convulsive respiration, followed by expiratory cessation of respiration for 20 sec. only broken by a couple of irregular respiratory movements. Pause of 20 sec. Strong, regular respiration.

2. Injection of air during 14 sec. Three irregular, slow respiratory movements. Pause of 53 sec. Strong, somewhat irregular respiration.

3. Injection of air during 14 sec. One convulsive respiration followed by absolute expiratory cessation of respiration. Pause of 48 sec. Strong, somewhat irregular respiration.

4. Injection of air during 14 sec. One convulsive respiration, followed by absolute expiratory cessation of respiration. Pause of 30 sec. Strong, quiet respiration.

5. Injection of air during 16 sec. Absolute expiratory cessation of respiration during that period. Pause of 27 sec. Quiet, strong respiration.

6. Injection of air during 17 sec. Expiratory cessation of respiration and irregular respiration. Pause of 25 sec. Quiet, strong respiration.

7. Injection of air during 12 sec. Expiratory cessation of respiration and irregular respiration. Pause of 20 sec. Strong, quiet respiration.

8. Injection of air during 8 sec. One quick, convulsive respiratory movement, followed by shallow respiration. Pause of 18 sec. Quiet, strong respiration.

9. Injection of air during 8 sec. One quick, convulsive respiratory movement, followed by expiratory respiration. Pause of 12 sec. Quiet, strong respiration.

10. Injection of air during 5 sec. One quick respiratory movement with expiratory cessation of respiration. Pause of 28 sec. Quiet, strong respiration.

11. Injection of air during 2 sec. One quick, convulsive respiratory movement, followed by a brief cessation of respiration. Pause of 1 1/2 min. Respiration somewhat irregular, as the animal was coming to, for which reason ether narcosis.

12 and 13. Injection of air during 1 sec. and, after renewed pause of 60 sec., 20 sec., gives the same result as before, namely, convulsive respiration and expiratory cessation of respiration.

As the general condition of the animal was very satisfactory, another series of experiments was also made; but these will not be described here, as their arrangement did not prove to be sufficiently satisfactory. The experiments were subsequently repeated with the necessary precautions, and will be described in detail under Experiment No. 4.

In this rabbit, as in the first two experiments with animals, all the injections of air brought about disturbances in respira-

tion. In nine out of thirteen times, the instant the pressure was exerted there was a very rapid respiratory movement, in which the inspiration and expiration followed one another so closely that the curve summit showed only as a perpendicular line. Immediately after there was a cessation of respiration of an expiratory type, and therefore designated as expiratory. In some instances the respiration ceased before the expiratory phase is completed. This suspension of respiration either continued as long as the pressure was kept up, or was finally succeeded, notwithstanding continued injection, by irregular, shallow, slow respiratory movements. Three times there was cessation of respiration without previous forced inspiration.

A complete survey of all the injections of air shows the following: The injection is followed every time by more or less pronounced respiratory disturbances. These are of various kinds. (1) One forced inspiration occurs, followed by one or more superficial respiratory movements. (2) The respiratory movements become slow and irregular. (3) Expiratory cessation of respiration ensues (24 out of 35 times). This cessation of respiration, which may be prefaced or concluded by one or two convulsive respiratory movements, continues without interruption as long as the irritation operates, or it may be succeeded by small, irregular respiratory movements. The irritation caused by the injection of air has no serious consequences for the animal. If the injection is continued for a sufficiently long time, the respiration begins once more, notwithstanding the continued pressure. The pulse does not seem to be affected in any way.

In the experiments hitherto described, air in the form of nitrogen gas has been used as the irritant. This mode of procedure has been adopted because, acting on clinical experience, it was natural to try the effect of a strong air pressure in the antrum upon the animal experimented with. It is evident, however, that the mode of procedure adopted has its weak point simply because we do not know with certainty whence the reflex comes. The air is injected into the antrum, but issues thence through the ostium maxillare and distributes itself over large areas of mucous membrane both inside and outside the nose, areas which may be the origin of reflexes. It appears, however, from Kratschmer's investigations, that

the expiratory cessation of respiration through the employment of gaseous irritants is started intranasally, and not from the lower down in the respiratory tract. The lower parts of the tracheal mucous membrane do not come under consideration here, as the animals were tracheotomized and the trachea firmly attached by ligature to the T-canula, so that all further advance of the air was precluded. It is therefore allowable to take for granted that it is an intranasal and not an extranasal reflex activity with which we here have to do. The question then is, from what part of the intranasal trigeminal region has the irritative effect issued? On this point we cannot, indeed, find out anything certain from the experiments up to the present reported. What we do know is that the atmospheric pressure in the antrum has been measured at 200 mm. Hg., while the pressure in the trachea has fallen right down to 12 centimeters water. We should therefore be able to take for granted that also the pressure in the nasal cavity itself is far less than within the antrum. It is in the antrum that the pressure has acted with its full force, and it is therefore probable that the reflex has come from the part of the trigeminal that is situated there.

Any doubt as to the possibility of reflex respiratory disturbances being set up from the mucous membrane of the antrum will disappear, however, from the result of the last animal experiment, which above all forms the foundation of the experimental part of this work.

It will be remembered that the clinical experience upon which the animal experiments were based was all connected with the treatment of diseased antra. In the experiments, however, we have had to do only with healthy antra. When we consider how very much more sensitive the inflamed mucous membrane of the antrum is than when in its normal condition, we must be justified in attributing a certain importance to this circumstance. Nor can we altogether ignore the fact that the animals were narcotized and therefore without feeling of pain. Knoll, who has experimented on animals both with and without narcotics, maintains, indeed, that the reflex action is the same. He has found no fundamental difference, but the simultaneous effect of the sensitive "*Erregungen auf die Psyche*" seems to condition an increase in the

reflexes from the respiration when the animal is not narcotized. The factors mentioned both go to show that other, possibly stronger stimuli should be tried, stimuli which, unlike the air injected, only exerted their irritative effect where they were applied. There is also another circumstance which should be mentioned in this connection. In going through the literature it was stated that some scientists have produced an effect upon the respiration by irritation of the nasal mucous membrane itself, an effect that in most cases manifested itself as an expiratory cessation of respiration. Thus far my results agree very well with earlier experiences; but when it comes to the reflex effect on the heart action it is a different matter. Here most writers have found marked vagus effect. During the injection of air, on the contrary, the heart's action, as already mentioned, did not appear to be affected. In any case the pulse curve shows no change, no sign of vagus effect. The blood pressure also remains unchanged. It might be imagined, however, that a specially powerful stimulation of the sensory trigeminal fibres in the antrum might also manifest itself as influencing the heart action in the direction indicated by earlier writers.

In accordance with what has here been pointed out, experiments were made with chemical stimuli, alcohol, ether and tincture of iodine. All these substances have in common the unfortunate property of destroying the mucous membrane, and thus making further experiments impossible. The application of these stimuli in the maxillary antrum is, however, easy and rapid in performance. They were nevertheless chosen. As there was an *a priori* reason for taking for granted that they would be capable of exerting an especially powerful irritative effect, and that this effect would presumably originate in the place of application.

Experiment No. 4.

Weight of rabbit, 2,100 grams.

Urethan narcosis 2 grams. Closed canula in the trachea, and antrum cannula in both maxillary antra. General condition of the animal excellent, with blood pressure of 130 mm. Hg. Respiration rather rapid, 48 per minute, but strong and regular throughout the experiment. 96 per cent of alcohol

and ether alternately was used as stimulus, 1/10 of a Pravaz syringe each time.

Alcohol in the right maxillary antrum produces instantly a violent reaction. There was first an absolute cessation of respiration for eight seconds, only interrupted by one convulsive inspiration, and then complete respiratory tetanus with a long series of convulsive respiratory movements, which did not cease until 35 seconds had elapsed. During the brief absolute cessation of respiration which concluded the irregular respiratory movements, the death of the animal was momentarily expected. This expectation, however, proved to be wrong. Respiration soon started again, and with as regular and strong respiratory movements as before the application of the irritant in the maxillary sinus. It was very interesting to find that during the respiratory paralysis there also occurred general paralysis with violent jerks in all the extremities and in the muscles of the face.

Of no less interest is a study of the blood pressure and the pulse curve after the alcohol injection. Whereas, the blood pressure, in all the previous experiments with injection of air, had remained unchanged and quite unaffected by the respiratory disturbances, this time we find a tremendous increase in the pressure of the blood, rising from 130 to 179 mm. Hg., an increase of 49 mm. Hg. The blood pressure remained high all through the respiratory spasm, but showed a somewhat falling tendency, so that when the respiration began once more, it was measured at 155 mm. Hg. The pulse curve, too, changed considerably after the alcohol injection. The pulse beats at first became slower, then small and irregular, and finally, during the greatest rise in the blood pressure, seemed to disappear altogether. During the spasms the pulse curve appeared as an almost straight line; but as soon as the convulsive stage was past and the respiration starts again, the pulse beats were once more seen in the curve, which acquired the same appearance as it had before the injection.

Throughout the pause of about two minutes which followed the alcohol injection, the respiration was strong and regular. The blood pressure remained relatively high, but fell by degrees to 142 mm. Hg. Alcohol was then injected into the left nasal cavity. In order to avoid injuring the mu-

cous membrane in the vestibule of the nose, which in the rabbit is very narrow, the nozzle of the springe was carefully guided 1 cm. into the nasal cavity, where the injection was made. Irregular respiration immediately began, but did not last more than three or four seconds, and did not seem to affect the animal in any way. After a few seconds the respiration continued quiet and strong as before. The rise in the blood pressure, however, which occurs immediately after the ether injection, is worthy of remark. The pressure rises from 142 to 166 mm. Hg., an increase of 18 mm. Hg. The blood pressure remains at this height for 28 seconds, and then falls again to 152 mm. Hg. On this occasion, too, the pulse curve loses its usual appearance and shows as an almost straight line.

After a pause of two minutes with quiet, strong respiration and a blood pressure which measured, at the end of the pause 123 mm. Hg., ether was applied to the left antrum.* Expiratory cessation of respiration for five seconds immediately occurred, and a rise in the blood pressure of 14 mm. Hg., from 123 to 137 mm. Hg. During the subsequent $1\frac{1}{2}$ minute's pause the respiration again became strong and irregular. The blood pressure measured 134 mm. Hg.

Ether in the right nasal cavity produced a convulsive respiratory movement, but did not affect the blood pressure.

After a pause of 50 and 60 seconds, ether and alcohol were again injected respectively into the right and left antrum, without appearing to affect the respiratory movements or the blood pressure in any way. The respiration continued unchanged, strong and regular, and the blood pressure was measured at 130 mm. Hg. until the experiments were discontinued.

The fact that the antrum mucous membrane did not react for stimuli after the first experiments is probably to be accounted for by the destruction of the ends of the nerves in the epithelium of the mucous membrane by the alcohol and ether injections.

*The small quantity of ether can be supposed to be evaporated after having been injected into the warm antrum. It is therefore possible, that there has been a more or less pronounced refrigeration, which cannot be compared to the strong irritation, caused by the alcohol.

In contrast with the first three experiments with animals, chemical stimuli have here been employed, namely, alcohol and ether. These were applied in the antrum and nasal cavity in the following order: (1) Alcohol in the right antrum, (2) alcohol in the left nasal cavity, (3) ether in the left antrum, (4) ether in the right nasal cavity, (5) ether in the right antrum, (6) alcohol in the left antrum. The experiments show that in this rabbit alcohol produced the more violent reaction and that the reactive effect was very much more pronounced with the application of the stimulus to the antrum than with injection into the nasal cavity; but also with the latter mode of procedure the effect, especially on the blood pressure, was indubitable. On the other hand, the reaction after the ether injection was not very marked, no change being found, for instance, in the blood pressure.

In this animal, as in the others, death was caused by air emboli when the air was injected between the antrum mucous membrane and the underlying bony wall.

For purposes of control, alcohol and ether were dropped into the antrum of another rabbit. The experiment will not, however, be reported in detail, because, among other reasons, the blood in the carotid canula coagulated, and therefore the pulse and the blood pressure could not be registered. I will only emphasize the fact that the effect on the respiration was pronounced (cessation of respiration), although of not nearly so violent a character as described above after the application of alcohol to the right antrum.

The four animal experiments here described, which should be viewed from one standpoint as a collected whole, will be sufficient to prove that by irritation of the mucous membrane of the antrum in the rabbit disturbances in respiration and blood pressure can be produced. These, however, are not dangerous for the animal when only injections of air are employed as stimulus; but if stronger stimuli, such as alcohol, are used, alarming phenomena will appear. In addition to the most violent disturbances in the respiration, tonic and clonic spasms may occur in the muscles of the face and extremities, and also a marked rise in the blood pressure.

The question now arises, how are these symptoms to be explained anatomically and physiologically?

The anatomic conditions which especially come under consideration in the intranasal neuroses will first be briefly mentioned. Figs. I and II. The maxillary antrum, as we know, receives its sensory innervation from the superior alveolar nerves, branches from the infraorbital nerve, which is one of the main stems of the second division of the trigeminal. This divides in the sphenomaxillary fossa into the infraorbital nerve and some other branches, of which the sphenopalatine nerves will be of special interest in this connection, for the sphenopalatines represent the sensory roots of the sphenopalatine ganglion, which is regarded by anatomists as a sympathetic ganglion, and is in direct connection with the plexus of sympathetic nerves round the internal carotid.

When it is a question of find out the way or ways that an irritation of the alveolar nerves may be supposed to take, attention must not only be directed to the principal way through the second branch of the trigeminal to the ganglion semilunare and on to the brain, but must also be turned to the nerve tracts to the sphenopalatine ganglion and the sympathetic system.

If the first way is followed, to the ganglion semilunare, where the cells of the sensory trigeminal fibers are situated, the following anatomic conditions must be kept in view. From the sensory trigeminal cells in the ganglion semilunare run centripetal filaments, sensory fibers of the first order, through the portio major into the brain. Here the fibers divide in the form of a T into a short ascending and a long descending branch. The descending branches form the so-called spinal tract of the fifth nerve. It runs right down to the upper part of the cervical spinal cord. In their course both the ascending and the descending branches send out numerous collaterals, which wind round the nerve cells grouped together upon their median side. These cells form in the pons a large nucleus, the so-called sensory nucleus of the fifth nerve; caudally they form the previously mentioned nucleus of the spinal tract of the fifth nerve. From these nerve cells issue the sensory fibers of the second order, the nerve offshoots that form the great quintothalamic tract, and which end in the thalamus, where the sensory neuroses of the third order running to the cortex have their origin. In what relation, then, do these sensory

offshoots from the trigeminal nucleus stand to the respiratory center?

The earliest idea, that the respiratory center, "neud vital," formed an asymmetrical center in the posterior angle of the calamus scriptorius, has now been abandoned, but its position in the medulla oblongata has not yet been established with certainty.

While some scientists place it in the reticular substance, especially the lateral gray reticular substance, others are of opinion that it is to be found in the ala cinerea area, or in the dorsal vagus nucleus and the nucleus of the solitary tract, situated in the floor of the fourth ventricle.

Great confusion has also prevailed regarding the course of the tracts that connect the respiratory center in the medulla oblongata with the motor nuclei for the nerves of the respiratory muscles, especially the phrenic nucleus and the nuclei of the intercostal nerves in the spinal medulla.

The most important recent work on this last subject is by Max Rothmann ("Ueber die spinalen Athmungsbahnen." *Arch. f. Anatomie u. Physiologie, Physiolog. Abteil.* Jahrg., 1902).

According to Rothmann, the involuntary respiratory center is to be found in the medulla oblongata in the gray reticular substance. The tracts for the innervation of the diaphragm run almost exclusively through the ventral part of the lateral column, and those for the thorax muscles (intercostal muscles) principally through the lateral part of the anterior column. After the destruction of the reticular substance in the medulla oblongata, these tracts appear to degenerate. Some of them are crossed, some are not. An irritation of the respiratory center will be transmitted through these tracts to the phrenic center and the intercostal nerve centers in the spinal cord, and bring about a contraction of the diaphragm and of the intercostal muscles.

The diagram (Fig. 1) shows how near, in the topographic sense, the sensory trigeminal nerves are to the respiratory center. We can imagine an irritation of the trigeminal tracts transmitted to the respiratory center in one of two ways, either by a direct radiation of collaterals from the spinal tract into the respiratory center (reticular substance), or the con-

nection may be more complicated—e. g., the nerve offshoots that issue from the cells in the nucleus of the spinal tract of the fifth nerve, and run upwards to the thalamus, may throw out collaterals to the reticular substance.

It would appear from the above that respiratory disturbances, regarded from an anatomic point of view, may very well be produced by the transmission of an irritation from the trigeminal to the involuntary respiratory center in the medulla oblongata, and thence to the respiratory muscles. What in this instance makes the matter more complicated is, however, that in one of the animals experimented upon, not only were respiratory disturbances proved to occur, but also, in connection with them, general spasms of the muscles of the face and extremities, together with a tremendous rise in the blood pressure.

As collaterals run from the fibers in the quintothalamic tract to the nucleus of the facial nerve, and also, according to the general belief, the reticular substance is united by connecting fibers to the adjacent nucleus of the facial nerve, it will be easily understood that an irritation of the terminal branches of the trigeminal may also cause spasms of the muscles of the face. The fact that the muscles of the extremities were likewise affected seems, however, to indicate that the stimulus, at any rate in this instance, has passed by the quintothalamic tract to the thalamus and thence onwards to the cortical substance, and that it is there, in the brain cortex, that the irritation has attacked the adjacent centers.

It will be remembered that during the injections of air the pulse curve did not show the slightest indication of change in any direction. On the employment of chemical stimuli, on the other hand, especially after the alcohol injection into the right antrum, a tremendous rise in the blood pressure immediately occurred. At the same time the pulse became first slow, then small and irregular, and finally, when the rise in the pressure had reached its maximum, almost entirely disappeared, so that the pulse curve only looks like a slightly undulating line in which the separate pulse beats can only just be distinguished. Very much the same reaction, although not so strong, is also found after an alcohol injection in the left nasal cavity. The great increase in the blood pressure can

only be accounted for in two ways, either by an increase in the work of the heart or by an increased resistance in the circulation. In the first case, the increased heart action throughout the rise in the blood pressure would manifest itself in the pulse curve by strong heart beats and high summits. It appears, however, from the above that this is far from being the case; indeed, the pulse beats in the curve are at last seen almost to disappear. The great rise in the blood pressure therefore cannot well be due to the increased heart activity.

It seems natural, then, to explain the rise in the blood pressure in the second way, namely, as the consequence of an increased resistance which the heart can at first overcome, but which at last becomes so strong that the heart is no longer able to continue its work with such force as to mark the systole in the greatly overfilled arteries, and in consequence the contractions of the heart are no longer recorded in the pulse curve, which appears as an almost straight line. The question now is: How is this increased resistance to be explained in connection with the other reflex phenomena?

One would here naturally think of a reflex irritation of the vasoconstrictor nerves. If we try to find an anatomic basis for an explanation of this reflex activity, the following anatomic conditions must not be lost sight of. The trigeminal branches running to the back of the nasal cavity (posterior superior and inferior nasal branches) pass through the sympathetic sphenopalatine ganglion, and, according to von Lenhossek's investigations, send out collaterals which envelope the sympathetic nerve cells in the ganglion. The latter again is in connection with the plexus of sympathetic nerves round the internal carotid. A stimulus that is transmitted through the trigeminal fibers to the ganglion may therefore be supposed to produce a constrictor impulse to the sympathetic plexus round the internal carotid. There seems little reason to suppose that the rise in the blood pressure in the cases before us is due only to a contraction of vessels within the carotid area. The natural explanation would rather appear to be that the irritation from the alveolar nerves has taken the previously mentioned way to the brain cortex, and that it is there that the impulse is transmitted to the vasoconstrictors.

As to how this transmission has taken place it is difficult, with our still imperfect knowledge of the central sympathetic centers and tracts, to express any decided opinion. I will only in this connection point out that according to Tigerstedt there are generally supposed to be two principal centers for the vasoconstrictor nerves. One of these is believed to be situated in the medulla oblongata, where the root fibers of the facial leave the continuation of the spinal cord (Frank), the other within the motor zone of the brain cortex. It thus appears from Weber's experiments that an irritation of the motor sphere in the cortical substance of the cerebrum not only produces ordinary muscle cramp, but is also followed by a distinct effect upon the muscles of the vascular system, the vessels innervated by the splanchnic nerve especially being contracted. Whether there are connecting fibers between the centers mentioned and the adjacent nerve centers in the continuation of the spinal cord, or the brain cortex, is not known as yet. It can only be said that in analogy with the conditions of other adjacent nerve centers where the connection has been anatomically ascertained, it is natural to suppose such connections also between these centers. The experiment before us seems at any rate to favor the idea that a transmission of the stimulus has taken place either in the medulla oblongata, or, as already pointed out, more probably within the motor sphere of the brain cortex around the central sulcus where the chief respiratory center and the motor centers and the vasoconstrictor center are to be found.

It has repeatedly been stated that the majority of investigators have found, after intranasal trigeminal irritation, a marked vagus effect both on respiration and heart action. As, however, in my animal experiments I have never been able to prove a vagus effect on the heart action, I have endeavored anatomically and physiologically to elucidate the phenomena observed, on the basis of the assumption that there has been no vagus irritation. I am, however, fully aware that my explanation of the symptoms is not in all respects entirely satisfactory.

We should have expected, for instance, that if the irritation had taken the course mentioned, through the respiratory center to the intercostal nerves and the phrenic nerve, a con-

traction of the intercostal muscles and of the diaphragm would have been started, and that this would have resulted in an inspiratory cessation of respiration. We get, on the contrary, an expiratory cessation of respiration, a phenomenon which more particularly favors the idea of an irritation of the bronchomotor vagus fibers. It would be remarkable, however, when we consider the whole origin of the motor vagus fibers to lungs and heart (the visceromotor vagus nucleus), if an irritation which affected the center were to exert its influence only on the bronchomotor fibers. It would seem natural for the irritation to be also transmitted to the heart fibers, with vagus effect on the heart as a consequence. With our present very imperfect knowledge of the central conducting paths and their mutual relations, it will hardly be possible to give an entirely satisfactory explanation of the symptoms before us. Nor can we altogether disregard the possibility that this may have been a combined irritation of various nerve centers, an irritaion which, owing to conditions unknown to us, in individual cases may act with unequal force upon various centers, and which therefore will give such widely different symptoms that from an anatomic point of view they can hardly be explained.

In connection with the report of the cases it was shown that the sudden and unexpected shock phenomena in the patients might, from a theoretic point of view, as well be ascribed to the anesthetizing as to the operation itself and the subsequent injection of air or syringing. As regards the first alternative it was pointed out that a cocain anesthesia, especially in a nervously disposed patient, who, moreover, owing to the disease, was not very capable of resistance, might well have had significance as a predisposing element, but that the cocain can scarcely have been the decisive factor.

The question then is whether the injection of air or syringing may not have had something to do with the phenomena. To this it may be answered that the symptoms observed during the animal experiments exhibit in a number of points a striking similarity to the phenomena that have been observed both by earlier writers and by myself in connection with antrum punctures. It will be remembered, for instance, that the cessation of respiration was at first the dominant

feature in all my cases. There are further the suggestive occurrences from the motor sphere, which were seen in my cases 1 and 2, in the first case general epileptoid convulsions, in the second a spastic condition of cramp in the trunk and extremities. In this connection it should be pointed out that with these patients there was not the slow, hard pulse mentioned by several writers, and supposed to be the expression of a vagus irritation from the trigeminus. In the three patients in whom there was opportunity of observing it, the pulse during the first part of the attack was uncountable, and afterwards small and rapid.

It thus appears that through irritation of even a healthy antrum mucous membrane, reflex conditions of irritation are produced in the rabbit, which greatly resemble the symptoms which, in man, occurred in conjunction with puncture of the antrum. It therefore cannot be denied that with sensitive persons, at any rate, increased air pressure or syringing, for instance with cold water (cf. Killian's case), may act as a sufficiently strong stimulus to the inflamed mucous membrane of an antrum, to set up reflex irritation phenomena of a serious nature. It happens, however, surely very seldom. As a rule, the alarming antrum phenomena will be interpreted in another, more obvious manner.

In the description of the animal experiments it was stated that some of the experiments failed, especially on account of one particular defect in the arrangement of the experiments. It was the defective technic in the perforation of the bony wall of the antrum which here gave trouble. One animal after another died of air emboli and emphysema. In each case autopsy showed the same result. The trocar had, it is true, perforated the bone, but not the mucous membrane, or at any rate not to a sufficient extent. The mucosa was torn away from the periosteum of the bony wall, the small blood vessels between being injured in consequence, and the air forced into the opened veins, with instantaneous death as the result. It was on the whole remarkable how difficult it was to avoid air emboli. With the facts learned from animal experiments, it was natural to enquire into the conditions in man, whether the mucous membrane here, too, could be so loosely attached to its bony substratum that a careful, slow

puncture such as must, owing to space conditions, be made in the case of the small animals experimented on, might be attended by the risk of detaching the mucous membrane. It is obvious that in man this complication is not of frequent occurrence. If the antrum picture were generally associated with a loosening of the mucous membrane of the antrum, the unfortunate consequences of this simple operation would undoubtedly be far more frequent than is the case. We see, however, that complications occur but seldom. I have myself, for instance, in a single series of investigations, punctured about 50 antra without one mishap. If, however, we wish to make a comparison between the conditions in the animals experimented on and those in man, care must be taken, as already said, that the puncture is performed in the same manner, and that the trocar is not pushed quickly through the wall, but slowly, little by little. It is, as we know, seldom that an antrum puncture is performed in this manner, but it will occasionally happen that the anatomic conditions prove to be such that the puncturing needle's progress is slow, namely, in those cases in which the bony wall in the lower meatus is so thick, and the bone of so firm a consistency, that it is really not possible to push the trocar through quickly. It is only antra where such conditions exist, that is to say, the small, thick walled ones, that can come under consideration here. Keeping these conditions in view, a series of investigations have been made, some on the dead body, others on patients. The antrum in one of the bodies examined was small, and with so thick a wall that it was only with great difficulty that the needle could be made to pierce it. It appeared that in this case the trocar detached the whole of the median mucous membrane of the antrum from its bony substratum, and pushed it in towards the lateral wall surface of the antrum without perforating the membrane. The mucosa was thick and swollen as a consequence of empyema in the antrum.

In the living subject examination was made during the performance of a radical antrum operation according to Luc-Caldwell. After removal of the facial wall, the light was thrown in towards the median wall of the maxillary antrum, simultaneously with the perforation of the bony wall from

the lower meatus. The relation of the mucous membrane to the needle during the operation could be observed with great exactness. In the patients examined the maxillæ were large and the antrum walls easily penetrated. In one of the patients the trocar was quickly and forcibly pushed into the antrum. The mucous membrane was instantly pierced, without any loosening. On the other hand, in another case where the mucosa was thick and swollen, the needle, by way of experiment, was introduced slowly and gradually. It then appeared that the trocar to a large extent detached the mucous membrane from the bone, and pushed it in towards the lumen of the antrum. The mucous membrane was pushed so far in before the perforation took place, that the operator in such a case would certainly take for granted that injection of air and syringing could be performed. It is clear that the result of an injection of air or water in these circumstances might be that the air would be blown into the opened blood vessels between the mucous membrane and the periosteum, and thence carried into the circulation. The question would thus be: What might be the consequences of such an injection of air into the blood? We here enter upon a chapter of medical science in which a considerable amount of uncertainty still appears to prevail.

THE AIR EMBOLUS.

The air embolus, with its dangers, has been the subject of careful research by many writers. It has long been known, for instance, that a forced injection into the veins of an animal may cause death. Harder, as long ago as 1684, injected air into the jugular vein of a dog, which died instantaneously. On dissection, frothy blood was found in the heart. Spontaneous entrance of air during an operation with lesion of the veins was first observed in 1806 by Verrier in a throat operation on a horse. The operative air embolus in a human being was not described until later. In 1824 Dupuytren published an account of one of the best known cases. During a throat operation a sucking kind of noise was suddenly heard and the patient died instantaneously. The postmortem showed air in all blood vessels, especially in the right heart. Since then a number of similar cases have been reported, not only

during throat and thorax operations, but also in lesions of the more peripherally situated venous trunks. The clinical description is very much the same. During the entrance of the air there is heard a gurgling, scraping noise, proceeding from the injured vein. Immediately afterwards a peculiar rattling sound is heard over the heart, where the percussion note becomes tympanitic. At the same time there is more or less irregular respiration, sometimes with convulsive, and sometimes with suspended respiratory movements and with irregular heart action. The patient may die instantaneously or after the lapse of some time, not infrequently in convulsions. Now and then the patient recovers without lasting injury. The results of autopsy do not always correspond. Certain investigators, for instance, have found air bubbles only in the right heart and the large venous trunks, while others claim to have found air in all the blood vessels of the body, at the same time maintaining that this air did not originate in the process of putrefaction. Hübl also found air bubbles in the small blood vessels of the spinal cord. All investigators emphasize the fact that it is primarily in the right heart that the accumulation of air is found. The right half of the heart is described by most of them as tightly filled and inflated like a balloon.

Opinions with regard to the cause of death differ greatly. Some consider that it has been a "lung death." The air is driven out by the right heart into the lung capillaries, which are embolized, and the circulation is interrupted with death as the result. It has sometimes been supposed that the air emboli have become fixed in the small blood vessels of the central nervous system, thereby causing a "brain death." Most writers seem to incline, however, to the view that the cause of death should be looked for in a paralysis of the heart and that thus the death as a rule has been a "heart death."

The numerous experiments on animals that have been made in this connection are of great interest, and on several points contribute valuable material towards the understanding of the air embolus and its dangers.

Theodor Jürgensen has made a great many experiments with dogs. They showed, in every case in which the animal did not die instantaneously, that air that was introduced into

the right crural artery could be traced in the left crural vein, even after the left crural artery was ligatured and the air bubbles were thus forced to pass through the collateral connecting lines. With inspiration, the air bubbles that could be seen in the vein were sucked up towards the heart, while with expiration they stood still or even moved back a little. After the air injections the respiratory movements were rapid, dyspneic. The respiration curves showed steep summits with large oscillations. When death was approaching the curves were still steep, but irregular and slow. In the case of one of the animals experimented on, 530 cc. was injected in the course of 48 minutes, and in another 2,730 cc. in the course of about 2½ hours, without causing any noticeable changes in respiration and heart action. It was proved that the air bubbles circulated for four or five hours.

There seemed to be no doubt that a rapid separation of the air from the blood took place, as it would otherwise be inconceivable that such large quantities of air should not produce more alarming symptoms than was the case. On dissection of the animals that were killed by rapid injection of large quantities of air, air was found in the arteries. The right heart was full of air and very frothy blood, and there was a considerable amount of blood mixed with large air bubbles in the large veins, while as a rule the left ventricle was almost entirely empty. It seems as if this part of the heart has been sufficiently powerful to expel the comparatively trifling amount of air left after passing through the lungs into the circulation. The writer draws attention, however, to the fact that the condition thus discovered by dissection cannot always be expected to occur. If, for instance, a large quantity of air is injected rapidly, so that the right heart is distended and becomes incapable of emptying its contents into the lungs, or if the air is introduced sufficiently slowly and carefully, there will probably be no free air bubbles to be found in the arterial vascular system. Jürgensen, however, considers it sufficiently proved, by his experiments with animals, that air from the right heart can actually be carried through the lungs to the left, and thence into the circulation.

The cause of death by air emboli is also mentioned by

Jürgensen, whose view is in accordance with that maintained by Couty. The latter writer, who has made a number of investigations of the blood pressure in the large vessels, distinguishes between several different groups of symptoms according to the amount of air injected, and believes that death may be caused in several ways.

1. Entrance of air without general disturbances.

After small quantities of air, a few cubic centimeters at once, or larger quantities introduced little by little through the veins, no general disturbances are seen. If the pressure in the large arteries is measured, it will be found to fall a little. Over the heart, too, a peculiar systolic murmur is heard, arising from the air intermingled blood in the right ventricle of the heart. Respiration is not affected.

2. Entrance of air with cerebral anemia.

It must then be presupposed that a large amount of air enters quickly. The consequence will be a lowering of the pressure in the large arteries (40 to 50 mm. Hg.). The systole becomes weaker, the pulse rapid, respiration frequent. In man the face turns pale and syncope ensues, after which all dangerous symptoms as a rule subside.

3. Entrance of air in large quantities, with disturbances in the circulation, especially with anemia of the brain and medulla oblongata.

In addition to the phenomena mentioned under heading 2, respiration is slow and spasms occur in all the striated muscles. In curarised dogs with opened thorax, a dilatation of the right auricle and ventricle is seen as a consequence of the overflowing with air, also venous reflex with venous pulse even in the smallest veins.

4. Entrance of air with disturbances in circulation, especially in the nervous organs.

These are disturbances that result in death. During a rapid lowering of blood pressure the previously mentioned symptoms appear in an intensified degree.

The physiologic basis is the same in groups 1 and 3. As a consequence of the arterial anemia, the brain is paralyzed in its function, and respiration and heart action cease.

In addition to Jürgensen's work, mention should be made, in this connection, of Ludwig Wolf's experimental studies

of air emboli. The last named writer also carried out his experiments on dogs, but as a rule injected the air into the right jugular vein, up to 200 cc. in the course of 45 minutes, in quantities of up to 50 cc. at a time. The animals reacted even with minimal quantities of air in the same way, labored, irregular, intermittent respiration, and irregular but strong pulse. The results of his experiments were as follows: The air introduced into the venous system is quickly conveyed to the right heart, where, even after the injection of minimal quantities of air, a humming sound is heard during compression of the aerated blood by the heart. On the entrance of larger quantities of air, dilatation of the right heart ensues with relative insufficiency and overfilling with air in the large venous trunks. From the right heart the pulmonary artery is filled with bubbles of air, which make their way into the lung capillaries. Beyond this, i. e., in the pulmonary veins and in the chambers of the left heart, Wolf has not been able to prove the presence of air in any great quantity, and maintains that those writers who, after venous emboli, have found air in the entire circulation, have made an error of observation. The air bubbles observed must have originated in processes of decomposition, or in the entrance of air during dissection. Wolf further alleges that the air embolizes the lung vessels, but that the resistance here encountered is overcome by the heart, if at the same time too great a number of capillaries is not blocked. The writer maintains, however, that a few air bubbles may also find their way into the capillaries of the pulmonary veins, and that in this way, through embolizing of blood vessels in the brain and spinal cord, or of the coronary arteries, death may ensue that cannot be called a lung death. He thinks, however, that this is rare. The general cause of death is embolism of the lung capillaries. It is therefore found that the fall of the blood pressure in the aorta is on a parallel with the amount of air injected, while the pressure in the pulmonary artery rises. What has become of the large quantities of air injected in the veins? It is not in the systemic circulation, nor yet in the right heart and the large veins, unless the whole of the pulmonary circulation is suddenly stopped by a great injection of air. The only explanation is that the air has escaped through the lungs. Cohn-

heim, who is an opposer of the theory of the embolic lung death, emphasizes indeed the fact that an animal can live even if only half of the pulmonary vessels are pervious. Wolf refers, however, to Lichtheim's investigations, which show that three-fourths of the pulmonary circulation must be put out of gear if the pressure in the aorta is to diminish, and points out that in those cases in which death is caused by aspiration of air into the vessels, it is probable that far more than half the vessels are embolized.

A number of investigators, among them Wolf, have proved that in an injection of air into the arterial system the air is carried with the blood through the entire system. Air introduced into the crural artery, for instance, is found as previously mentioned, in the crural vein on the opposite side. Heller, Mager and von Schrötter have also described manège moments, paralyses, loss of consciousness, tetanic cramps, spastic paralysis and paraplegia, symptoms which all point to capillary emboli in the systemic circulation. Autopsy showed hyperemia of the lungs and, contrary to what is found with venous emboli, air throughout the circulation. Similar conditions are also found, as Jürgensen has shown, with air emboli issuing from the ventricle and the abdominal veins. According to Wolf, the case of venous emboli from the abdominal vessels differs somewhat from the usual cases of venous emboli; for as the air passes through the capillaries of the portal system it is liable, just as in its passage through the capillaries of the systemic circulation, to an equally strong pressure from all sides, and is in consequence so finely distributed throughout the blood that it can, to some extent at any rate, make its way through the pulmonary circulation. The large air bubbles, which might possibly form on the way to the lungs, do not appear in such numbers as to cause a simultaneous embolization of large sections of the lung, and thereby bring about serious consequences. The lungs form, on the whole, the organism's most powerful defense against the air that has entered into the blood, as they give to the systemic circulation the protection of a rampart. When once the air bubbles have entered the systemic circulation, the danger of serious complications will be considerably greater. They will then embolize vital vessels, with death as the result.

It will be seen from the investigations that I have carried out for the purpose of ascertaining the condition of the mucous membrane during the trephining of the antrum wall, that a loosening of the mucous membrane in special circumstances may very well be assumed to take place. It will further be remembered that in several of the cases described, it is stated that the antrum wall was thick. This was the case with two of my patients, and I had not the usual well known feeling of the bone suddenly yielding and the trocar gliding into a cavity. The resistance was too strong for this. It was supposed that the bone was punctured because the trocar had penetrated so far that even a very thick antrum wall must have been perforated, and because the point of the cannula could be moved a little in various directions. The air was then injected, and a kind of bubbling sound was heard, which might, however, also have been supposed to be made by the air as it made its way under the bleeding mucous membrane. It is noteworthy that with both these patients there was a certain interval between the injection of the air and the occurrence of the phenomena. In the case of the one patient, for instance, the injection of air had ceased, and it was not until the syringe had been transferred to the water receptacle that the symptoms made their appearance. This also seems to favor the belief that it was a case of embolus. How great a quantity of air may have been forced into the vessels cannot be precisely stated; but with neither of the two patients in question was the ball of the syringe compressed more than twice at the most. As the bulb, when filled to the maximum, does not contain more than about 48 cc., the quantity of air injected cannot have been very great. It will be remembered that Wolf, without serious consequences for the animal, injected as much as 50 cc. at a time; but this, it must be borne in mind, was in one of the main venous trunks, the jugular vein, so that the whole of the 50 cc. was injected into the blood stream. In an antrum puncture, however, the conditions must be quite different. The air does not then make its way into the lumen of a large vein, but is forced into the small veins that are torn away when the mucous membrane is detached from the bone. It is therefore unlikely that any great quantity of air has entered the vascular system. In all prob-

ability only a few air bubbles are forced into the circulation, and it is then a question whether these could cause the alarming symptoms. It will be apparent from the investigations mentioned that small quantities of air in the venous system cannot produce dangerous phenomena. These can only occur when the air passes into the arterial circulation. Jürgensen has proved, however, not only that air in the arterial system passes without difficulty through the lung capillaries, but also that air bubbles in the venous system, at any rate from the vena linealis, may pass into the greater circulation. Wolf himself, who is also an ardent defender of the lung death theory, admits that even the venous air embolus may be carried into the arterial system. He points out that the paralyse, clonic and spastic contractions, etc., described by Heller. Maßer and von Schrötter, really indicate capillary emboli in the systemic circulation.

If these investigations are compared with my two cases in which there have probably been air emboli, it will be seen that it is first and foremost the arterial embolus of which there can here be any question. The symptoms, at any rate, strongly favor this view. Judging from the animal experiments, the venous emboli produce phenomena first of all from the lungs, heavy, irregular respiration. Otherwise the animals showed an astonishing power of resistance to air in great quantities. There is no doubt that the same conditions may also assert themselves in human beings. The following history of a case will be of some interest in this connection.

A pregnant and very anemic woman of about 30, in the State Hospital ear ward, underwent a right sided mastoid operation, with exposure of the sigmoid sinus, the walls of which appeared to be unusually thin and pulsated strongly. After the bandages had been changed several times, about a fortnight after the operation, the patient was to be moved to the maternity hospital on account of her approaching delivery. As no time was to be lost (the pains had already begun), the dressing was done with all possible speed in the ward. Directly the old bandage was removed, a continuous, long drawn, sucking sound was heard, though this was not at once diagnosed as an air embolus. Immediately after, however, the same sound was heard again, and the patient fell to the ground

with loud cries of pain, which was first located over the heart, and directly after over the dorsal surface of the right lung. For a little while the patient was somewhat short of breath, but in a couple of hours was able to be moved to the maternity hospital, where the same day she gave birth to twins and subsequently suffered no inconvenience from her embolus. The sucking of air, in this case, into the sinus only ceased at the moment the patient collapsed. There is no doubt that a considerable quantity of air had been sucked in. The symptoms seem most nearly to resemble Couty's group II. The description of the attack shows that the air could be clinically followed on its way first to the heart and then to the lungs, where its further passage to the systemic circulation seemed to be arrested. It is probable that here the air disappeared from the blood in the following manner. After entering the circulation it is immediately taken up by the hemoglobin, and oxyhemoglobin is formed, whereby the amount of air is reduced 20 per cent. The nitrogen remaining has thus, practically speaking, become pure—that is to say, it has circulated in the blood with a tension of one atmosphere. When this air in the pulmonary veins has begun to mingle by diffusion with air in the pulmonary alveoli, where the tension of the nitrogen is only about four-fifths of an atmosphere, nitrogen is diffused from the air in the veins into the air of the pulmonary alveoli. It will be seen how very widely the features of this case differ from the phenomena that occurred in those of the two antrum patients. In the case of the woman mentioned, there was a large, practically continuous venous air embolus; while in the two antrum patients there was in all probability an arterial air embolus. In the latter cases the small air bubbles must have been able to pass through the lungs and to enter the general circulation, where, by embolizing vital vessels in the central nervous system, they have set up the alarming symptoms.

In reading the history of the cases I have mentioned at the beginning of this work, it will be seen at in addition to my two cases Nos. 1 and 2, air emboli probably also occurred in a number of the other cases described (cf. Claus' Nos. 1 and 4, Neuenborn's, Zarniko's, Fleischer's, Holmgren's and Roll-Hansen's). In most of these cases the bony wall was hard

and difficult to penetrate. The symptoms, moreover, occurred in connection with the injection of air.

The assumption of air emboli is applicable to most cases described, but not to all of them. In my patient No. 3, for instance, the wall of the antrum was thin and the cavity very large. The postmortem showed that no detachment of the mucous membrane had taken place. It will, moreover, be noticed that the dangerous phenomena did not always occur in conjunction with the injection of air, but during the actual syringing (Claus' No. 3 and Henrici's Nos. 1 and 2). In Killian's patient, too, the shock came upon syringing with cold water. If the syringing has been undertaken after a loosening of the mucous membrane inside the antrum wall, it may be likely that also in these cases an air embolus has taken place. Whether, in these patients, it has been an antrum reflex or an air embolus with which we have had to do, can of course never be ascertained; but from my experiments with animals it would appear that the possibility of an antrum reflex ought to be given some consideration. When the question of a nasal "embolus or antrum reflex neurosis" is brought forward, we here enter upon a subject of which very little is told in our special literature, but which, in other medical literature, has been thoroughly worked up in another connection.

It is well known that during the puncture of another cavity, namely, the pleural cavity, alarming phenomena of an uncertain, often mysterious character, now and then occur, and it has not yet been decided whether these are due to air emboli or to a reflex from the pleura.

In connection with this question—antrum reflex or air embolus, it will without doubt be interesting to recall the views that have been put forward with regard to the pleural cavity.

It has long been a well known fact that in affections of the pleura various more or less serious phenomena of an unknown nature may occur, sometimes spontaneously, with great exudation or pneumonias, sometimes in connection with operations on the pleura.

Forlanini classes the symptoms under the heads psychic, motor, circulatory and respiratory. The psychic symptoms manifest themselves in loss of consciousness for long or short periods without lasting effects. The motor symptoms present

themselves partly as spasms, partly as paralyses, often spasms alone, tonic or clonic, which come on simultaneously with the loss of consciousness, and affect most of the muscles. The spasms are often, though not always, one sided. The paralyses are flaccid, monoplegic or hemiplegic. The symptoms from the circulatory and respiratory systems are paretic with small pulse, slightly cyanotic skin and mucous membranes. The respiration is shallow, even ceasing altogether, so that artificial respiration may be necessary. There have also been a number of cases in which operations on the pleura have even resulted in death.

It is needless to say that these accounts published by Forlanini and other well known writers have attracted much attention and have been the subject of considerable discussion in the special literature. A great difference of opinion prevails, however, among both clinical writers and pathologic anatomists, as to the manner in which the phenomena are to be explained. There are especially two views that are of importance. One of these, the embolus theory, which has its warmest adherents among German medical men, maintains that the above mentioned symptoms and death are due to emboli, above all air emboli, resulting from the lesion of the pulmonary veins with the nozzle of the syringe and the injection of nitrogen into the systemic circulation. The negative result of many of the postmortem examinations is not considered to be unfavorable to the theory of air emboli, partly, because the autopsy was not always done with sufficient exactitude, and partly because the air embolus, after inflicting injury, may have been again absorbed.

The other view, the reflex theory, which has gained ground more especially among French and Italian scientists, maintains that the phenomena described by Forlanini and others must be regarded as a pleural reflex, a pleural eclampsia. By this is understood a shock effect produced reflexly from the pleura, and passing either to the circulatory center and the heart, with a heart death, to the respiratory center with disturbance or cessation of respiration, or to the brain with nervous disturbances, loss of consciousness, spasms and paralyses.

As typical attacks have even been brought on by merely introducing the needle into the pleural cavity without injecting

air at all, and as the phenomena are not infrequently transitory, reappearing as soon as the manipulation is repeated, the adherents of the reflex theory are of opinion that emboli cannot be considered probable. As a point in their favor they adduce the frequent entirely negative results of dissection.

One of the writers on this subject, Brauer, takes up an intermediate standpoint. He is of opinion, indeed, that in puncture of the pleura emboli form the commonest complication, and that gas emboli are the natural explanation, especially in the more serious cases; but on the other hand he admits that a reflex from the pleura may occur, although he believes this to be comparatively seldom. He has himself described an undoubted case of pleural reflex arising from the costal pleura. In the case of a patient with pneumothorax who was to be treated for the first time, an attack of suffocation occurred when the cannula came in contact with the exposed costal pleura, a spasm of the glottis, which did not subside until five minutes had elapsed. After an interval of 15 minutes, a light touch with a probe again produced a similar attack. After anesthetizing with novocain, the pleura was punctured with a forcible thrust, a fresh, though less violent attack being brought on. On the other hand, the subsequent treatment with numerous punctures was carried out without complications. It is obvious that there cannot well be any question of air emboli in this case.

The careful study of the literature which Begtrup-Hansen has exhibited in his work on artificial pneumothorax seems to indicate that even serious phenomena which are not always capable of explanation by the embolus theory, may really occur in consequence of even slight pleura manipulations such as an exploratory puncture or the changing of a drainage tube, or merely through touching the pleura. It is sufficiently apparent from the highly instructive controversy between the Swedish doctors, Professor Carl Sundberg and Dr. Em. Lindhagen, on the subject of Sundberg's paper on the cause of the sudden deaths under the pneumothorax treatment, that in the individual cases it will often be extremely difficult, not to say impossible, to decide definitely the question "embolus or reflex." The instructive articles are well calculated to convince

the reader of the difficulty there may be in answering the question in any one given case.

It is obvious that the conditions that apply to the pleura do not permit of being transferred without more ado to the maxillary antrum. The views that are urged for and against a pleura reflex on the one hand and an air embolus on the other, are nevertheless of some interest to us and must therefore not be passed over in a discussion such as this.

Just as there may be difficulty in explaining definitely the symptoms that may appear in connection with a thoracocentesis, so will it be impossible in each separate case to give a satisfactory explanation of the phenomena that are described after an antrum puncture. Nor has this been the primary aim of this work. The main object has been to give an account of the factors that have to be taken into consideration in an antrum puncture, and to direct attention to conditions which, as far as I know, have not been brought forward either in text-books or in our special literature.

As previously pointed out, taken relatively, the serious symptoms appear seldom,* but they are nevertheless of considerable importance from the fact that these phenomena, when they do occur, are fraught with the greatest danger to the life of the patient. We ought therefore to make up our minds that antrum puncture, though apparently such a simple operation, is yet not entirely free from all risk.

The question then is how this risk, which may attend puncture, is, if possible, to be avoided. There are in particular two factors which should be taken into consideration in an antrum puncture. One is the narrow, stenosed ostium maxillare, the other, which is of still greater importance, the thick, firm antrum wall.

If the ostium maxillare, notwithstanding the usual cocaineizing, is stenosed, so that the advance of the air through the ostium is impeded, the opening in the lower meatus, especially in more acute sinusitis with tender mucous membrane, should

*In reality, however, these antrum cases do not appear so rarely as is generally believed. During a discussion on this paper in the Oto-Laryngological Society in Stockholm, several cases were mentioned by Prof. Barany, Dr. Henning, Dr. Sture Berggren and Dr. Ohman.

be made sufficiently large for the air and water to pass through it without too greatly increasing the pressure in the antrum.

If the wall of the lower meatus is so thick and offers such resistance to the insertion of the trocar that the needle can only penetrate the bony wall very gradually, it would perhaps be safest to withdraw the needle, and instead choose the way through the middle meatus. If, for some reason or other, it is nevertheless considered desirable to use the trocar through the lower meatus, the utmost caution should be exercised, as under these conditions it is impossible to be certain that there has been no loosening of the mucous membrane. It might then be better on the whole not to give an injection of air, but on the contrary to endeavor, by aspiration, to make the diagnosis clear, if one does not prefer at once to make a large opening.

In conclusion it is my agreeable duty to offer to Professor S. Torup, head of the Physiological Institute of the Kristiania University, my thanks for his assistance during the preparation of this work.

My thanks are also due to Professor Kr. Schreiner, director of the Anatomical Institute of the University, for his kind readiness to assist me in the numerous very complicated anatomic questions which are opened up in this work, and in no less a degree for his choice of the anatomic drawings which have so greatly facilitated a comprehension of the anatomic conditions that here come under consideration.

I would also take this opportunity of expressing my sincere thanks to Professor Holger Möllgaard, Professor E. Schmiegelow, of Copenhagen, and to Dr. Andreas Janberg, of Kristiania, as also to those of my colleagues who have kindly allowed me to report their cases.

BRANCHES FROM THE MAXILLARY NERVE.

1. Meningeal nerve (middle).
2. Zygomatic nerve.
 - 2 a. Zygomatic facial branch.
 - 2 b. Zygomatic temporal branch.
 - 2 c. Anastomosis between zygomatic temporal branch and lacrimal nerve.
3. Sphenopalatine nerves.
4. Infraorbital nerve.
 - 4 a. Superior posterior alveolar branches.
 - 4 b. Superior middle alveolar branch.
 - 4 c. Superior anterior alveolar branch.
 - 4 d. Superior dental plexus.
 - 4 e. Terminal branches of infraorbital nerve (inferior palpebral, nasal and superior labial branches).
5. Sphenopalatine ganglion.
- 6-9. Branches from sphenopalatine ganglion.
6. Posterior superior nasal branches (median and lateral).
7. Anterior palatine nerve.
 - 7 a. Posterior inferior nasal branches.
8. Median palatine nerve.
9. Posterior palatine nerve.
10. Nerve of the pterygoid (Vidian) canal (great superficial petrosal nerve and deep petrosal nerve).

BRANCHES FROM OPHTHALMIC NERVE.

11. Nasociliary nerves.
12. Frontal nerve.
13. Lacrimal nerve.
 - 13 a. Terminal branches of lacrimal nerve.
14. Spinal tract of trigeminal nerve
15. Nucleus of spinal tract of trigeminal nerve
16. Quintothalamic tract.
17. Gray reticular substance (respiratory center in medulla oblongata).
18. Nucleus of facial nerve.
19. Root fibers of facial nerve.
- 20, 21. Descending tracts issuing from the respiratory center and ending round the nuclei of the phrenic and intercostal nerves in the spinal medulla.
22. Phrenic nerve, motor root fibers.
23. Motor root fibers of intercostal nerves.

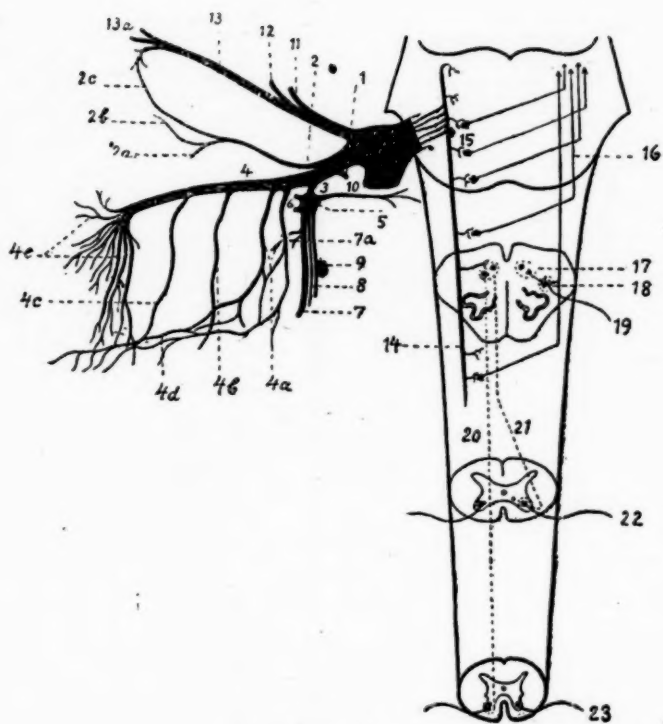


FIGURE I.

Diagram of the peripheral branches from the maxillary nerve, the central trigeminal tracts and their connections with the respiratory center and the facial nucleus.



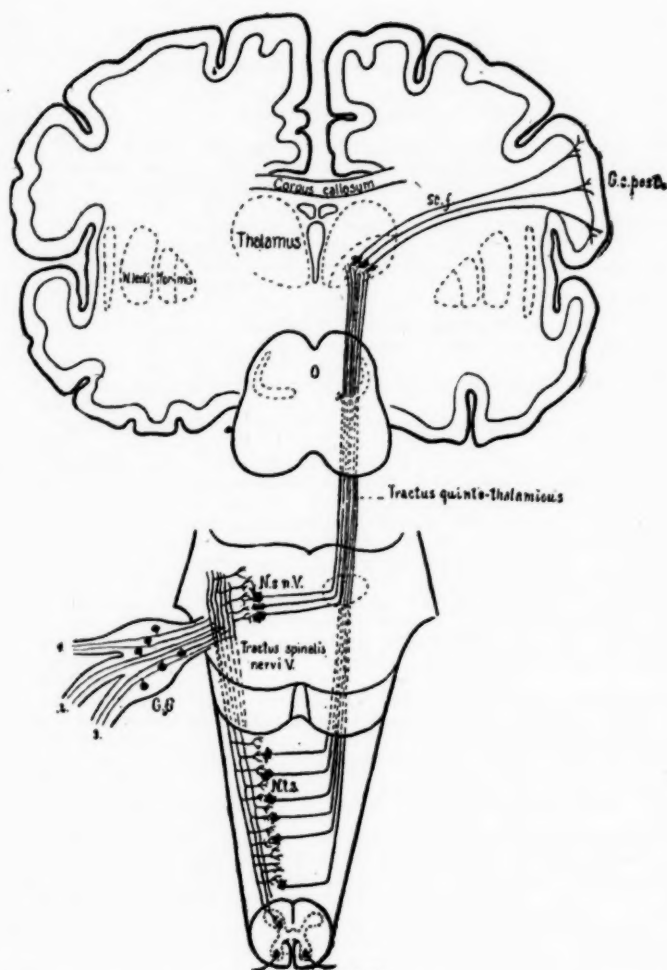


FIGURE II.

The central trigeminal tracts (from Bechterew). 1, 2, 3, = the 1st, 2nd and 3rd branches of the trigeminal; G. G. = Gasserian ganglion; G. c. post. = posterior central gyrus; N. s. n. V. = sensory nucleus of the trigeminal nerve; N. t. s. = nucleus of the spinal tract of the trigeminal nerve; sc. f. = subcortical fibers from the thalamus to the lower part of the posterior central gyrus.

On the left of the drawing a connection between the descending trigeminal root and the respiratory center is indicated. On the right there is an indication of the connection between the respiratory center and the nucleus of the facial, and further the way in which collaterals run from the fibers in the quintothalamic tract to the cells in the nucleus of the facial.



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XLIII.

CASE OF SARCOMA OF THE NASOPHARYNX WITH SOME INTERESTING FEATURES.

BY DUNBAR ROY, A. B., M. D.,

ATLANTA.

At the annual meeting of this society in 1909 the writer presented the history of a case of sarcoma of the sphenoid with additional remarks concerning the literature bearing upon this particular subject. The present case, while differing somewhat from the other in its anatomic location, yet showed many similar clinical symptoms and points of interest in that they were developed very gradually and the writer had the opportunity of watching these throughout the course of the disease.

Mrs. R. T. B., white, age 70, consulted me in the summer of 1916 on account of some deafness in the left ear.

Mrs. B. was a frail little woman, although she had never had a serious spell of illness in her life except as mentioned below.

Family history, negative as far as any positive record of systemic dyscrasia.

The only complaint elicited from the patient was the fact that she was becoming deaf in the left ear, accompanied by a feeling of fullness. She had never had earaches or discharging ears as a child, and she was comparatively free from colds. She was also troubled with an enlarged gland just below the ramus of the lower jaw on the right side. This was about the size of the end of the thumb and slightly tender.

Nasal cavities: Right side free and normal in appearance. Left side, narrow and a small nasal spur at the base of the septum.

Nasopharynx: Appearance normal with the exception of a slight swelling in the neighborhood of the mouth of the left eustachian tube. Pharynx and tonsils normal.

Ears: Right, canal and drum normal. Hearing normal. Left, canal normal. Drum slightly thickened. Watch heard

on contact and forced whisper at two feet. Tuning fork C heard much longer by bone conduction.

The catheter was passed with some difficulty and inflation only partially accomplished.

Treatment at this time consisted in the internal administration of small doses of the iodid of potassium and mercury salve to the enlarged gland. The left ear was treated by inflations. At no time was there any bleeding from the passing of the catheter. The patient improved only slightly, and in a few weeks left for her old home in Alabama.

February 27, 1917, seven months later, the patient again consulted me on account of the left ear. She seemed some weaker in appearance. The patient gave me the interim history as follows: Soon after returning home she had an attack of gall stones and suffered intensely. This was treated medically and she was relieved without any operation. At the same time the enlarged gland on the right side disappeared, and examination showed this statement to be correct. Apparently she was feeling much better, with the exception of the increasing tinnitus and deafness in the left ear and with considerable difficulty in breathing through the left nasal cavity. In fact, at night she was compelled to breathe entirely through the mouth. This symptom was telling most decidedly on the equilibrium of her nervous system.

Examination: The pharynx showed thickening and bulging of the soft palate on the left side. No ulceration was found. The tonsils appeared normal. The patient talked with a decided symptom of paralysis of the soft palate, as is seen sometimes after diphtheria. The right nasal cavity appeared normal.

On the left side there can be seen a firm gelatinous looking growth far back at its junction with the nasopharynx. Manipulation shows it to be of firm consistency and bleeding very slightly when touched.

It was impossible to pass the eustachian catheter on that side, as the growth involved that whole upper part of the nasopharynx. A clinical diagnosis of sarcoma of the nasal cavity and nasopharynx was made. On account of previous experiences with the operative treatment in this class of cases, I advised the use of radium immediately.

A tube containing ten milligrams of radium was placed immediately against the growth through the nasal cavity and allowed to remain one hour. This was repeated every fifth day until four applications had been used. No very marked reaction or improvement could be seen at the end of this time, and the patient desiring to visit her son in Memphis, Tenn., was advised to make the trip and consult Dr. E. C. Ellett in that city. One month later I received a letter from Dr. Ellett stating that a Wassermann showed a plus two in the case of Mrs. B., and that two salvarsan injections had been given, with great improvement in the patient's condition and they greatly hoped that she would be cured. Three months later the patient returned to Atlanta and brought me the following note:

"Memphis, Tenn., October 2, 1917.

"Dear Dr. Roy—You probably remember the case of Mrs. B., whom you saw last spring. A reference to your notes will recall to your memory the fact that the question of diagnosis was between specific trouble and malignancy.

"She left Atlanta and came here to Dr. Ellett, who referred her to me.

"A Wassermann gave plus two positive, and she was, of course, put upon antisppecific treatment, getting three doses of salvarsan and iodid internally with mercurial injections.

For a time there was improvement which, however, might have been the result of the radium treatment which she had in Atlanta. At any rate, a continuation of the antisppecific treatment has not resulted in continued improvement. I think she has had a fair test of the antisppecific treatment without benefit, and had, therefore, best be treated with radium in the future. Very sincerely,
"JNO. M. MAURY."

Another thorough examination of our patient showed that the growth had much increased and that the ethmoid cells on the left side were being invaded.

I then advised her daughter to take Mrs. B. to Dr. Kelly's hospital in Baltimore, where she could obtain more intensive radium treatment, as I thought this was the only chance for prolonging her mother's life.

This advice was taken. Dr. C. V. Burnham sent me the following report: "Section from nasopharynx growth small

round cell sarcoma. The X-ray plates of the head give no evidence of any bony growth, and while the left antrum appears cloudy, this may be due to the position of the head."

The patient remained in the Baltimore hospital for four months, receiving radium treatments as follows:

- Nov. 28, 1917, 1,198 mgs., 2 hours, applied to neck.
- Nov. 30, 480 mgs., 1 hour, applied to neck.
- Dec. 2, 2,494 mgs., 1 hour, applied to neck.
- Dec. 4, 1,024 mgs., 3 min., direct to neck.
- Dec. 6, 844 mgs., 1 hour, applied to neck.
- Dec. 8, 1238 mgs., 2 hours, applied to neck.
- Dec. 10, 1,015 mgs., 1 hour, applied to left cheek.
- Dec. 14, 500 mgs., 1 hour, applied to neck.
- Dec. 16, 917 mgs., 1 hour, applied to neck.
- Dec. 12, 958 mgs., 1 hour, applied to neck.
- Jan. 4, 1918, 764 mgs., 1 hour, applied to neck.
- Jan. 6, 842 mgs., 1 hour, applied to neck.
- Jan. 7, 971 mgs., 1 hour, applied to neck.
- Jan. 9, 1,857 mgs., $\frac{3}{4}$ hour, applied to neck.
- Jan. 11, 531 mgs., 3 min., direct to throat.
- Jan. 13, 760 mgs., $5\frac{1}{2}$ min., direct to nose and throat.
- Jan. 15, 1,163 mgs., 1 hour, applied to head.
- Jan. 17, 694 mgs., 3 min., direct to nose and throat.
- Jan. 19, 873 mgs., 1 hour, applied to neck.
- Jan. 21, 1,200 mgs., 1 hour, applied direct to neck.
- Jan. 23, 1,011 mgs., 1 hour, applied direct to neck.
- Jan. 25, 764 mgs., 2 min., direct to nasopharynx.
- Jan. 28, 965 mgs., 1 hour, applied to neck.
- Jan. 30, 1,065 mgs., 1 hour, applied to neck.
- Feb. 1, 1,060 mgs., 1 hour, applied to neck.
- Feb. 4, 999 mgs., 1 hour, applied to neck.
- Feb. 6, 953 mgs., 1 hour, applied to neck.
- Feb. 8, 501 mgs., 4 min., direct to throat.
- Feb. 11, 1,159 mgs., 1 hour, applied to neck.
- Feb. 13, 883 mgs., 3 min., direct to throat.
- Feb. 15, 495 mgs., $1\frac{1}{2}$ min., direct to throat.
- Feb. 16, 594 mgs., 3 min., direct to throat.
- Feb. 18, 1,009 mgs., 1 hour, applied to left side of head.
- Feb. 20, 1,058 mgs., 1 hour, applied to left side of head.
- Feb. 23, 1,150 mgs., 1 hour, applied to neck.

Feb. 25, 1,096 mgs., 1 hour, applied to neck.
Feb. 27, 1,078 mgs., 1 hour, applied to neck.
Feb. 28, 805 mgs., 1½ hour, applied to head.
March 4, 1,137 mgs., 1 hour, applied to neck.
March 6, 615 mgs., 1 hour, applied to neck.
March 8, 628 mgs., 6 min., direct to nasopharynx.
March 11, 1,031 mgs., 1 hour, applied to neck.
March 13, 1,118 mgs., 1 hour, applied to neck.
March 15, 1,097 mgs., 1 hour, applied to neck.
March 19, 959 mgs., 6 min., direct to throat.

On her history chart the following note was made at the time of the last visit: "The right eustachian tube easily seen. Left one not seen very well. Left nostril quite difficult to enter. The patient cannot breathe through the left nostril, but blows through it better than she used to. Growth is much reduced. There is a defect in soft palate on left. Swelling on the left side is quite small compared to what it was, but there is just as much discharge as ever."

An office examination made by me on her return showed the following condition: Patient certainly seems stronger and in better spirits. The growth in the nasopharynx had been reduced at least two-thirds. The left nasal cavity posteriorly is completely filled with the growth, accompanied by a profuse purulent discharge which is quite offensive. The nasal cavity was kept as clean as possible. The hearing in the left ear was practically negative. The patient returned to her old home in Alabama expecting later to again have the radium treatment in Baltimore. However, the patient's condition gradually became worse, and in two months she died, evidently from a generous sarcomatous toxemia.

Remarks: The fact that this case showed a plus two Wassermann reaction is by no means unusual. Pathologists tell us that it is not uncommon to have a positive Wassermann in cases of malignant growths, tuberculosis, malaria and other similar conditions.

It is for this reason the writer believes that too much confidence is placed in this test for the determination of syphilis. In a paper before this society last year he called attention especially to this one fact. The partial disappearance of the nasopharyngeal portion of the growth under the influence of

radium was indeed remarkable. The writer would not have believed that such was possible had not the case been under his own personal observation. Had not the growth penetrated into the vascular region of the ethmoid cells the patient might have gotten far better results. Early recognition of malignant growths in the nasopharynx and the early application of large doses of radium offer the best chance for its cure, and to the mind of the writer is the rational method of handling these cases. The use of radium has passed the experimental stage.

To the writer the chapter on sarcoma of the nasal cavities and nasopharynx is one of the darkest pages in rhinologic literature. It has been my misfortune to have charge of eight cases of sarcoma of the nasopharynx, and although every known method of treatment was used, operative, electropuncture, Coley's fluid, radium, ligation of the carotids, etc., they all died, so that I have come to the point of being in full accord with Dr. Shambaugh, who said: "Most of the cases of sarcoma of the nose reported as cured by operation may have really been mistakes in diagnosis in which inflammatory tissue was mistaken for sarcoma."

Only two of these eight cases have ever been reported by me, and I am sure that this experience of mine coincides with that of many other rhinologists who have treated such cases and have never published the same, consequently the bibliographic statistics in reference to nasal sarcoma must be absolutely misleading. In fact, it will be found by reading the summary of cases appended to this article that it is remarkable how frequently the immediate results are given in a case following a successful operation, and, on the other hand, how few of the end results are reported on these very same cases.

It is certainly unfortunate to be so pessimistic, but the management of these malignant growths and a study of the final results honestly reported certainly does not add one ray of optimism. The writer has long viewed with a suspicious eye the presence of any growth in the nasal cavities of the young adult situated in the region of the ethmoid and which is accompanied by periodic epistaxis and which bleeds freely with the slightest manipulation.

Eighteen years ago a young man seventeen years of age

consulted me on account of periodic epistaxis. Examination showed small red warty gelatinous growth on the middle turbinate of the right side. Concluding without microscopic examination that the same was probably an angioma, I removed it without difficulty and with very little hemorrhage. In two days the surface looked normal, and the young man returned home. One month later he again appeared, with difficulty in breathing on that side. An examination showed a hard vascular diffused growth in the whole apex of the nose. Sarcoma was immediately suspected, which was confirmed by the microscope. Active treatment was immediately instituted. Evidently the whole ethmoid body was infiltrated, and an operation by extirpation was out of the question. Ligation of the common carotid was immediately performed. Coley's fluid, which at that time was being greatly extolled, was most consistently used. Radium had not as yet been tried. In spite of all that was done the growth gradually invaded the whole ethmoid body on both sides, and in two months' time he presented the most horrible picture I have ever seen. The bridge of the nose was almost on the same line with the side of the face. The frontal bone at the root of the nose stuck out like a small sized orange. Both eyes were protruded and immobile. He died shortly from exhaustion and sarcomatous infiltration of the brain substance.

The literature on the subject of sarcoma of the nasal cavities and nasopharynx is quite extensive, but it throws very little light on any curative measures which can be used for its management. Numerous cases have been reported as cured, but the writer is firmly convinced that there must be different degrees of malignancy or that there has been a mistaken diagnosis.

It is not the intention of the writer to discuss the bibliography of this subject nor to discuss statistics. This has been done in numerous articles, all of which have added very little to the one important phase, which is, What is the best line of treatment in this class of cases, both as to the final result and as to the future comfort of the patient? However, in order to make this subject more complete the writer has compiled in statistical form the various reports which have been published dealing with sarcoma of the nose and nasopharynx, em-

bracing the subject of the different methods of treatment which were used in each case and the results obtained.

In 1910 there appeared in the Transactions of this society a paper by our lamented member, Dr. J. Price Brown. It was a plea for the more conservative surgery of nasal sarcoma by the use of the electrocautery operation. The arguments adduced by Dr. Brown were most logically reinforced by a study of the results obtained by others in the use of the more radical operation with the knife. The following quotation from this article is worthy of more than ordinary consideration: "The site of formation of the sarcoma is at the back end of a bony box situated in the middle of the face and below the floor of the skull. Although this box is fragile and split in two by a bony wall, yet each half is abundantly provided with spongy tissues which are filled to repletion with capillaries and blood vessels, glands and lymphatic channels, more abundantly probably in proportion to its size than any other region of the body. In this tissue, whatever may be the cause, the sarcoma has its origin, and, taking on the attributes incident to its position, it grows rapidly, fills itself with blood spaces and bleeds easily. When the surgeon becoming alarmed by its size proceeds to operate, he not only removes the neoplasm but the bony tissues that surround it in order to take away every vestige of the disease. At the same time the lymphatic channels and blood spaces so freely opened by the operation are ready to carry any germs that may remain to a deeper habitation, and the early recurrence of the disease in so many cases proves the correctness of this conclusion."

There is a world of truth in this statement. When the antrum is involved the force of these remarks are not so applicable, for we all realize that anything short of a complete resection of the superior maxilla is inadvisable, although even this will probably be futile. There have been numerous reports of the most excellent results obtained in the treatment of sarcoma in different parts of the body by the use of radium therapy. The writer is convinced in his own mind that should he personally ever be afflicted with sarcoma of the nasal passages he would much prefer the final results probably to be obtained by this latter method of treatment than any surgical procedure.

A very interesting article has lately been published by Eiken, reviewing the experiences at Rovsing's private clinic with roentgen treatment of sarcoma. The results reported in a number of cases were certainly most encouraging. One case in particular was a sarcoma of the orbit where both surgical and roentgen treatment were used in conjunction with a successful result.

The writer has now under his observation a young girl, 16 years of age, who developed at the age of 10 a sarcoma of the upper lid, extending partly in the orbit. The tumor has been removed five times, and at the last two operations 50 mg. of radium was left deep in the wound for four hours after operation and then the wound was closed. At present radium is being used externally at varying intervals with apparent success. This case has been under observation for six years. The rapid disappearance in the size of the growth accomplished by the use of the radium in this case is certainly most gratifying, and there is no doubt that the use of this remedy is aiding our patient both in comfort and prolongation of life.

If one will study the literature of this subject, especially in reference to the treatment, he will be surprised to find that the real good results from treatment have been obtained by the use of the X-ray and radium, and especially the latter. The writer believes that the possibilities from radium treatment are still in their infancy, and that the next few years will show the reports of many cases where malignant growths in the nose and nasopharynx have yielded to this mysterious remedy in a manner far superior to all other known methods of treatment, especially the so-called operative procedures.

REVIEW OF LITERATURE.

GENERAL DISCUSSIONS AND COLLECTION OF CASES.

ARRANGED BY DATE.

SARCOMA OF THE NASAL SEPTUM.

Clark, J. P. Amer. Laryngol. Assoc. Trans., 1898—XX—183.

Bosworth in 1889 collected 41 cases of nasal sarcoma, about half of which were sarcoma of the septum; in 1891 the author added 7 cases to this list; in 1896, Boylan added 14 more.

Since 1896 the author has found 14 cases, and consulted reports of 10 of these. Boylan says of the 21 cases which he analyzed (seven of which were noted by the author in 1891) that in 2 cases no operation was attempted, in 2 cases it was admittedly incomplete, leaving 17 in which extirpation was attempted. Of these, in 5 no later history is given, in 7 the length of time the case was observed after operation is not given; in only 3 is it distinctly stated that there was no recurrence a year or more after operation. In Boylan's case the growth was removed by a snare, and the site thoroughly curetted. No sign of recurrence for over a year after operation.

In the 10 cases since 1896 reviewed by the author 7 died of the disease, in 1 the growth was so extensive that operation was considered inadvisable; another case was lost sight of. The one which recovered (no recurrence over 2 years later) was operated with snare and curette. In one of the 7 fatal cases no operation was attempted. The author reports one new case; radical operation; operation June 1, 1897; no recurrence March 28, 1898.

PRIMARY SARCOMA OF THE NOSE.

Harris, T. J. Phila. Month. Med. J., 1899—I—337.

Reports 5 cases of his own, to which he adds 57 cases in addition to Bosworth's report. This makes a total of 103 cases. An analysis of these 103 cases shows that the termination was not stated in 48 cases; that in the 55 cases remaining, 25 (or 46 per cent) are reported as dead. There is one case reported as recovered after operation, nature of operation not stated; 11 cases without recurrence 6 to 12 months after intranasal operation; 4 cases without recurrence at end of 2 years after intranasal operation; 11 cases without recurrence 6 months to 1 year after external operation; 3 cases without recurrence at end of 2 years after external operation. A year is not sufficient length of time to prove a cure. So the mortality is probably higher than indicated by the above statistics. In regard to treatment, Dr. Harris says: "Operation is indicated at the earliest possible moment. In many cases a radical operation is the proper method, but in cases

in which the entire tumor is thoroughly exposed to view and in reach an internasal operation only is justified."

MALIGNANT DISEASE OF THE NOSE AND ACCESSORY SINUSES.

Gibb, J. S. N. York State J. Med., 1902—II—24, 56.

Gibb gives a tabulation and summary of 111 cases of sarcoma of the nasal chambers, 3 cases of sarcoma of the antrum and sinuses, 12 cases of sarcoma of the nasopharynx.

In the first and largest group—sarcoma of the nasal chambers—subsequent history is given in 31 cases after the complete eradication, in 4 cases 1 month elapsed, 13 cases from 2 to 12 months, 9 cases from 1 to 2 years, 3 cases from 2 to 3 years, 1 case from 3 to 4 years, and 1 case in 7 years without recurrence.

In regard to methods of treatment in these cases, the author says: "The earlier the case is seen before encroachment upon surrounding tissues has taken place the more is to be expected from operative interference. Small growths with moderate attachments may be removed by intranasal methods—e. g, the snare, cautery and curette, with very fair prospect of ultimate success. When the growth has extended beyond the confines of the nasal chambers and involved the sinuses little can be accomplished through intranasal methods. In these more advanced cases only the most thorough and complete radical measures offer the least prospect of success."

In the 12 cases of sarcoma of the nasopharynx, there were but two in which no recurrence had taken place at the time of the report, and in these the interval was too brief to base conclusions (four months and one year, respectively). In the case in which there was no recurrence for a year, the growth was removed by galvanocautery snare; in the other case by radical operation (third operation). In the three cases of sarcoma of the antrum and sinuses, one case had no recurrence after eight years, following a radical operation.

MALIGNANT GROWTHS OF NOSE AND NASOPHARYNX.

Cobb, F. C. Am. Laryngol., Rhinol. and Otol. Soc. Trans., 1904—X—147; also in Laryngoscope, 1904—XIV—577.

Reports from records of the hospital 11 cases of sarcoma of the nose: "The operations done varied from removal by

revulsion in the early cases to excision of the upper jaw in the later cases. In only the early cases do we find the report 'cured,' and these were by evulsion and before careful examination by the rhinologist. Even the cases most radically operated showed signs of regrowth almost before leaving the hospital." Author also reports three cases from private practice, all resulting unfavorably, "although operated by the best surgeons and by the most radical methods."

This author says: "Removal by intranasal method as a palliative measure may be advised where some indication prevents operation by a more radical method. Where such method is resorted to the galvanocautery loop is probably the safest instrument, although the cold wire snare, if carefully and slowly used, may be recommended. The success attending the major operations, such as excision of the jaw, is very far from encouraging, yet operation may be resorted to as a forlorn hope, or to relieve the urgency of some of the symptoms. There always remains a faint possibility of success, although the prognosis, even with the most radical operations, is extremely doubtful.

SARCOMATA OF THE NASAL SEPTUM.

Johnston, R. H. Laryngoscope, 1904—XIV—454.

Says in regard to treatment, that the medical treatment can only be palliative and applied to inoperable cases. Arsenic may be used in these cases. The intranasal operation is to be preferred, especially where the diagnosis has been made promptly and the entire growth can probably be removed. The possible methods are tearing out with forceps, excision, curetting, cauterizing and electrolysis. "Probably the safest operation is the removal of the growth or as much of it as possible by the hot snare. This procedure can be followed by the curette and cautery if necessary. The cautery should be applied not only to the base of the growth but to the surrounding tissue." Sometimes the tumor can best be removed at several successive operations. The author adds a list of 71 cases of sarcoma of the nasal septum, 31 of which are recorded as having recovered after operation, while in 14 there was recurrence in a short time or in a few years.

In the others the result is not given. The nature of the treatment is not included in his tabulation.

SARCOMA OF THE NASAL PASSAGES—150 CASES.

Watson, J. A. *Am. Med.*, 1904—VII—553.

Reviews 150 cases, including those reported by Bosworth and Gibb. The ultimate history of 45 cases does not appear in the records; of the remaining 105 cases, 62 patients are stated to have recovered; in only 28 of these 62 does the history subsequent to treatment extend over a period longer than six months, which renders the statement of recovery in the remaining 34 cases almost useless.

In regard to the method of treatment, 48 cases were submitted to radical operation, of which subsequent history was not reported in 13, recurrence or death in 16, recovery and freedom from recurrence for a variable period in 19; percentage of cure in radical operation, 39.58. In 64 cases, treated by intranasal operation, result not stated in 8, recovery in 35; recurrence or death in 21; percentage of recoveries, 54.68. "Apart from surgical measures the only treatment worthy of consideration is that by toxins, either or streptococcus erysipielatis or Coley's fluid. In none of the cases of the present series in which this treatment was tried was there any noticeable improvement." Author reports four cases:

No. 1. Removed by cold wire snare, no curettement. No recurrence "in almost two years."

No. 2. Tumor removed in several operations, using snares, forceps and curette. No recurrence in a year and a half.

No. 3. Part of tumor removed by intranasal operation, with relief of symptoms; radical operation refused; disease stationary at time of report (over two years after operation); several attacks of erysipelas, which may have retarded growth.

No. 4. Tumor removed by cold snare. No recurrence in several months.

CONTRIBUTION A L'ETUDE DES SARCOMES DES FOSSES NATALES.

Delamarre, A. Thesis, Paris, 1905.

Treatment must be surgical; medical treatment is indicated only when the tumor is inoperable. If the tumor is

limited to the nasal fossa, the endonasal route may be employed; the tumor removed at a single or several operations, and the site thoroughly cauterized. If the tumor is located too far up, or has spread too widely to be reached by the intranasal route, an external operation is indicated. The author prefers the Moure operation, or for a tumor extending to the maxillary sinus, a combination of the Moure and Caldwell-Luc operation.

The author has collected 27 cases, including three of his own. Of these 10 are reported as having died; 2 were without recurrence, 6 and 9 months after radical operation; 1 without recurrence 6 months after intranasal operation; in the remainder, there was either early recurrence or no definite statement of results.

STATISTICAL REPORT ON RESULTS OF OPERATION IN SARCOMA
OF THE NOSE.

Brown, J. P. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis,
1906—XV.

Brown gathered reports by personal communication from fifty laryngologists in the United States and Canada.

Of the cases reported 20 were inoperable; there were 19 intranasal operations with 6 recoveries (19 per cent); 33 extranasal operations with 8 recoveries (24 per cent). Total permanent recoveries after operations, 13 out of 51, or 27 per cent.

Reports in detail his fourth case treated by electrocautery; death from sepsis. This case is included in his later reports.

PRIMARY MELANOSARCOMA OF THE NOSE. REVIEW OF
LITERATURE.

Coakley, C. G. *Am. Laryngol., Rhinol. and Otol. Soc. Trans.*,
1907—430.

Reports one case of melanosisarcoma of the nose, of which portions were removed by the knife, and by the cold wire snare, at three different operations. Curettage and the galvanocautery were recommended by the author in the case, but refused by the patient. A powder containing powdered suprarenal gland and antipyrin was given to aid in controlling hemorrhage. Final results not reported.

The author adds case reports of 16 other cases of melanoma of the nose, making a total of 17 cases. Of these 17 cases, seven are reported as having died, and of these seven, five were subjected to extensive operations. Of the remainder, two patients (cases 3 and 5) "probably did not live very long, judging from the reported condition." Case 7 had no recurrence after 15 years, case 5 none after 1½ years; case 6 recurred slightly after three years and was reoperated. Case 9 recurred in two months, was operated on and "some months" later was free from return. Case 10, no recurrence after 1½ years; case 12, slight recurrence after three months, reoperated, and no recurrence after a year and a half. The author says:

"All of these cases reported as nonrecurring were treated by curettage, galvanocautery snare, thermocautery, or some combination of these therapeutic measures. This has so impressed me that should my patient consent to allow me to attempt a cure I will adopt them in preference to more radical surgical procedures."

SARCOMA OF THE NOSE.

Downie, W. Glasgow Med. J., 1907—LXVIII—103.

Reports six cases of sarcoma of nose, two inoperable on account of extent of tumor.

One case operated by Volkmann spoon and electrocautery; small recurrences were removed at different times later, but patient did not remain under observation.

One case operated by Rouge's method; general health good and no recurrence three years later.

One case tumor partially removed; cubiform plate involved; death from extension to meninges.

One case, several growths removed; later recurrences removed, and surfaces cauterized very freely. Some of the earlier growths partially myxomatous in character, partially sarcomatous; some later growths definitely sarcomatous. No recurrence in four months after last cauterization.

The author says in regard to treatment: Where the growth is wholly intranasal, "it should be removed through the nares by punch forceps, curettes, etc., followed by the free use of

the electric cautery. The repetition of such operative procedures may be necessary time and again until the affected structures are extirpated. When the disease is recognized early and treated in this fashion, the prognosis, I think, will be more than favorable. When the septum is involved, and where the area from which the new growth springs is widespread, its eradication may be made more easy and more satisfactory by having recourse to Rouge's operation."

DIE MALIGNEN TUMOREN DER INNEREN NASE.

Harmer, L., and Glas, E. *Deutsche Zeitschr. f. Chir.*, 1907—LXXXIX—433.

Report deals mostly with carcinoma, includes six cases of sarcoma, no late report obtained for one case operated endonasally; in another operated endonasally, no recurrence in a year. The four other cases had radical external operations; one of these had recurrence and died; the others had no symptoms of recurrence in one year to fifteen months after operation.

These authors in their general discussion mention the Roentgen ray and radium as methods of treatment, but in relation to nasal carcinoma only.

SARCOMA OF THE NOSE AND NASOPHARYNX.

Farrel, T. H. *Am. Laryngol., Rhinol. and Otol. Soc. Trans.*, 1910—203; Also in: *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1911—XX—67.

Reports one case sarcoma of nose, radical operation, removal of left superior maxilla; recurrences in nasal fossæ curetted several times and finally left external carotid artery ligated. Treated with arsenic. Later, recurrence in nasopharynx, operated, with good operative result. But general health became bad and patient died.

Eighteen cases of nasal sarcoma collected by author in addition to the one reported above and to those reported by Watson (1904). "In the large majority of these cases surgical treatment was the one relied on, though benefit is claimed from X-rays in one, injections of adrenalin solution in another, and yellow oxid of mercury ointment with an alkalin

spray in still another. The percentage of cures by external operation has been unusually large, viz., three out of five. In nine cases submitted to internal operations recovery occurred four times, recurrence or death four times, and the result was unknown in one. The extended experience I had with the one case would prejudice me in favor of intranasal operations. A radical antrum operation would have accomplished quite as much as the excision of the maxilla."

MALIGNANT TUMORS OF THE NASOPHARYNX.

Kelsey, A. L., and Brown, J. M. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1913—XXII—1147.

The authors, in discussion of treatment, mention one case reported of malignant tumor of the nasopharynx (not stated whether sarcoma or not) "where the tumor disappeared after using radium, but the patient died six months later of meningitis, leading us to believe that the tumor, though apparently gone from the nasopharynx, was really progressing and had finally invaded the brain."

In regard to medical treatment, "the injection of alcohol, formalin, adrenalin and Coley's fluid has been tried with little success, only two cases being reported cured, one from the use of alcohol, and one by the use of formalin. Ligation of carotid artery is credited with one cured case."

"Many palliative and radical operations have been done by various methods, but the final results have proven very inadequate. Rhinologists, generally speaking, have stood against radical operations and favor conservative procedures, such as curettage, because it has been found that a large percentage of patients radically operated have not survived the operation."

The authors report one case of sarcoma of the nasopharynx removed by snare and curette through the nose. Recurrence in a few weeks and death.

UEBER DIE PRIMAREN MALIGNEN GESCHWULSTE DES
NESEN-RACHEN-RAUMES.

Oppikofer, E. *Arch. f. Laryngol. u. Rhinol.*, 1913—
XXVII—526.

Author reports eleven cases of sarcoma of the nasopharynx, of which three were treated with arsenic alone; six with

Roentgen ray and arsenic internally; one with the Roentgen ray and morphin, and one was operated four times in all on account of recurrences, each operation followed by prolonged arsenic treatment. In two of the cases treated by Roentgen ray and arsenic, the tumor diminished in size and symptoms improved at first, but the improvement was not lasting and both cases died. The one case operated was examined and reported free from symptoms and tumor four years after the last operation. This was a lymphosarcoma. The author believes that these malignant tumors can be cured only occasionally by operation, even if combined with arsenic treatment. The Roentgen ray may relieve symptoms and reduce the size of the tumor temporarily, but does not effect a cure. Also fulguration, radium, thorium, etc., result in cure only very seldom, according to present reports (1913).

UEBER PRIMARE BOSARTIGE GESCHWULSTE DER NASENHÖHLE
UND DER NASENNEBENHÖHLEN.

Safranck, J. Beitr. z. klin. Chir., 1913—LXXXIV—126.

The author advocates operation of the most radical nature that can be undertaken with consideration of the condition of the patient. He believes Roentgen therapy, radium and also arsenic are to be used chiefly as postoperative measures, and also in cases so far advanced as to be inoperable. He reports two cases of nasal sarcoma operated. Final results not stated.

LES TUMEURS MALIGNES DES SINUS DU NEZ ET DE LA CAVITÉ
NASOPHARYNGIENNE,

Sendziak, J. Arch. internat. d. Laryngol., 1913—XXXVII
—371.

The treatment of malignant tumors of the lateral sinus of the nose and of the nasopharynx is primarily surgical. All attempts to use "pseudospecific" serums (Coley's, erysipelas, etc.), as well as arsenic, do not give favorable results. It is only in operable cases or after surgical intervention that arsenic is indicated. Also electrolysis, the Roentgen ray, radium and the galvanocautery may also be employed in such cases. In some cases operation by the external route is indicated.

TRAITEMENT ET PRONOSTIC DES TUMEURS MALIGNES DES FOSSES
NASALES ET DE L'HYPHARYNX.

Ferreri, G. Arch. internat. d. Laryngol., 1913-14—XXXVI
—337, 133; XXXVII—77, 414.

Reports a series of 65 cases of malignant tumor of the nasal fossæ and hypopharynx; of these, 44 were sarcoma. Of these 27 (57.35 per cent) were reported as cured by operation.

SARCOMA OF THE NOSE AND NASOPHARYNX.

Dighton, A. Brit. J. Surg., 1914-15—II—384.

In a brief summary of the subject the author says, in regard to sarcoma of the nose: "All treatments, both operative and otherwise, have been tried with no very marked success. Bosworth says: The only treatment is the thorough and complete eradication of the growth, and this at the earliest period possible without regard to the character of the tissue; and this seems to be the recognized treatment today. Various operations have been described. Price-Brown recommends the electric cautery, but this treatment is open to the objection that many sarcoma seem to take on renewed life after its use." In sarcoma of the nasopharynx, "as in sarcoma of the nose, all methods have been tried and multitudinous operations invented with but little if any success."

The author reports a case of nasopharyngeal sarcoma. Radical operation. No report on later history.

CASE REPORTS.

1904 TO DATE.

I. CASES OPERATED (INCLUDING ELECTROCAUTERY).

ARRANGED BY DATE.

NOTES ON CASES OF SARCOMA OF THE NOSE

(IN ADDITION TO THOSE CITED BY FARRELL, 1911.)

Brown, J. Price. Am. Laryngol. Assoc. Trans., 1903—XXV
—209; 1905—XXVII—322.

First article reports first three cases of sarcoma of the nose treated by the electrocautery (repeated operations) combined with snare and scissor removal of parts of the tumor when necessary. The first case, no recurrence after 8½ years; the

second case, no recurrence in 9 months; the third case still under observation and treatment, much improved.

In second report (1905), first case 10½ years without recurrence; second case, 2 years and 9 months without recurrence. The third case still had recurrences, but general health was good, and new growths were promptly treated by electrocautery. (See also case reports by Brown, 1909 and 1910.)

SARCOMA OF THE NASAL FOSSA.

Johnson, R. H. Med. Rec., 1906—LXX—909.

Reports one case operated, but without any attempt to remove the entire tumor, which was large and very vascular. Recurrence and death.

NASAL SARCOMA, WITH REPORT OF A CASE.

Watson, J. A. Laryngoscope, 1906—XVI—812.

Reports one case in addition to those noted in his 1904 article. Growth filled lower part of nasal fossa anteriorly; removed entirely by cold wire snare. No recurrence in 18 months. "This case substantiates the opinion expressed by the writer that intranasal operation is justifiable in many, if not in most, cases of sarcoma of the nasal passages."

PATIENT FROM WHOSE LEFT NOSTRIL A LARGE SARCOMATOUS TUMOR WAS REMOVED. NO RECURRENCE.

Connal, J. G. Glasgow Med. J., 1907—LXVII—58.

Reports one case of sarcoma of the nose removed at several sittings with scissors and cold snare, followed by thorough cauterization of the parts by electrocautery. No recurrence in 3½ years. Also mentioned a similar case treated in the same way; no recurrence in three years.

SOME OPERATIONS FOR REMOVAL OF MALIGNANT GROWTHS FROM THE NASOPHARYNX.

Eve., F. Brit. Med. J., 1907—I—485.

Reports two cases of sarcoma of the nasopharynx operated radically by osteoplastic resection of the upper jaw. One of these died from shock three hours after the operation. In

the other, operative results were good; operation in September, no recurrence the following January.

Also reports a case operated by Nélatno's technic for sarcoma of the upper part of the nasopharynx. Operation June, 1905; no recurrence at last examination, in March, 1907.

ANGIOSARCOME DE LA CLOISON NASALE.

Bourguet, J. Toulouse Méd., 2nd ser., 1908—X—249.

Angiosarcoma of the nasal septum; removed by intranasal operation. Arsenic given after operation. Slight recurrence, which author believes can be arrested and removed.

MALIGNANT DISEASE OF THE NOSE.

Holmes, E. M. Am. Laryngol., Rhinol. and Otol. Soc. Trans., 1908, 260.

Includes three cases of sarcoma of the nose, all of extensive growth, all operated, but without cure. One case was greatly improved for a few months after operation, but this improvement was followed by recurrence and death. The other two died soon after being operated.

PRIMARY SARCOMA OF THE NASOPHARYNX. REPORT OF CASE.

McCaw, J. F. Laryngoscope, 1908—XVIII—968.

One case, sarcoma of the nasopharynx, operated by splitting soft palate and removing as much of growth as possible; daily injections of adrenalin chlorid given later; finally ligation of the carotid artery which led to temporary improvement. Recurrence with no hope of recovery.

SOME RECENT CASES OF NASAL SARCOMA.

Brown, J. Price. Ann. Otol., Rhinol. and Laryngol., 1909—XVIII—793. Also in Am. Laryngol. Assoc. Trans., 1909, 219. Same Cases Reported in Article in Journ. Laryngol., 1909—XXIV—352.

Reports his third case as without recurrence for 2½ years. The other two cases also well and without recurrence. (See his case reports, 1905.)

Reports one new case (No. 4), operative results good after several electrocautery treatments, but septic symptoms developed and death ensued.

Case 5, treated by electrocautery; growth removed; breathing normal. General health good; no recurrence for more than a month.

Case 6, treated with repeated electrocauterizations; nose free and tumor practically destroyed; case under observation.

Case 7, electrocautery, and curetting forceps also used. Improvement marked; under observation.

FURET, F.

Rev. hebdomadaire de laryngologie, 1909—I—721.

No recurrence in four months after the Moure operation. Author states this is not sufficient time to judge of final results.

TWO CASES OF SARCOMA OF THE NOSE.

Brown, J. Price. Laryngoscope, 1910—XX—510.

See also article in Amer. Laryngol., Rhinol. and Otol. Soc. Trans., 1910, 255.

Two cases of nasal sarcoma, removed by electrocautery, with repeated operations for recurrences. Both cases at time of report had no signs of recurrence for several weeks; were under observation, and any new growths that might appear would be treated by electrocautery. The condition in the second case was not as good as in the first, but was being controlled at the time of the report.

NASAL MYXOSARCOMA IN A CHILD OF THREE YEARS.

Ross, G. T. Ann. Otol., Rhinol. and Laryngol., 1909—XVIII—562. Also in Laryngoscope, 1910—XX—188.

Intranasal operation with forceps, scissors and electrocautery, repeated four times for recurrences. Last operation November 30, 1908. On May 1, 1909, child entirely well; no sign of recurrence.

EIN LANGDAUERNDER FALL VON SARCOMA NASI.

Sonnenschein, R. Arch. f. Laryngol. u. Rhinol., 1909—XXII—413.

Reports a case lasting 11½ years, in which the sarcoma or parts of it were repeatedly removed with galvanocautery,

snare, etc., but no radical operation. Patient still living at time of report, with growth in nose, enlarged glands, evidence of metastases.

Reviews literature briefly, without giving statistics of treatment, but states as his conclusion that operation is the treatment of choice.

FIBROSARCOMA OF THE NOSE REMOVED AFTER TEMPORARY LIGATURE OF BOTH CAROTID ARTERIES AND LARYNGECTOMY.

Harmer, D. Royal Soc. Med. Proc. 3; Clin. Sect. 122, 1909-10.

Large growth in left nostril projecting into orbit and antrum and into nasopharynx. Temporary ligature of both external carotid and laryngotomy to prevent hemorrhage; radical removal of tumor. Operative result good. No signs of recurrence two months later.

CASE OF INTRANASAL SARCOMA.

Scarlett, R. B. N. York M. J., 1910—XCII—708.

Case of spindle cell sarcoma in left nasal chamber and antrum. External radical operation. Recurrence and death in about a year.

CASE OF MYXOFIBROSARCOMA OF THE NOSE AND NASOPHARYNX; REMOVED. RECURRENCE.

Dougherty, D. S. Laryngoscope, 1911—XXI—650.

Essential facts indicated in above title.

CASE OF NASAL SARCOMA.

Knight, C. H. Laryngoscope, 1911—XXI—784. Also in Am. Laryngol. Assoc. Trans., 1911, 159.

One case; tumor removed with wire snare, followed by cauterization with trichloracetic acid. No return until thirteen years after, when another tumor of similar histologic type, "alveolar sarcoma," was removed by external operation. No recurrence for $3\frac{1}{2}$ years.

SARCOMA OF THE NASAL FOSSA.

Peck, C. H. *Ann. Surg.*, 1911—LIII—856.

One case, sarcoma of nasal fossa, right side. Removed by radical operation. Good operative result. No later report.

CONTRIBUTION A L'ETUDE DES TUMEURS MALIGNES DU NASOPHARYNX.

Aboulker, H. *Bull. d'oto-rhino-laryngol.*, 1912—XV—115.

Deals mostly with cancer. Reports only one case of fibrosarcoma of the nasopharynx. Thorough curettage. Recurrence of symptoms and death.

CASE OF MELANOTIC SARCOMA OF THE NOSE.

Wilkinson, G. J. *Laryngol.*, 1912—XXVII—1.

One case melanotic sarcoma; radical operation. Operated November, 1911, reported January, 1912, in excellent health, with no signs of recurrence, but considerable deformity owing to the operation.

SARCOMA OF THE NOSE.

Dighton, A. *Brit. J. Surg.*, 1913—I—207.

Reports one case operated with good immediate results. No report on later result.

OPERIRTER FALL EINES IN DIE LINKEN NASENNEBENHOHLEN SICH ERSTRECKENDEN SARKOMS.

Safranek, J. *Pest. Med. Chir. Presse*, 1913—XLIX—93.

Reports one case of nasal sarcoma; radical operation; immediate results good. Later results not reported.

NASOPHARYNGEAL MYXOSARCOMA; SEVERAL OPERATIONS AND FINAL SPONTANEOUS RECOVERY.

Ingals, E. F. *Ann. Otol., Rhinol. and Laryngol.*, 1914—XXIII—373. Also in *Am. Laryngol. Assoc. Trans.*, 1914—XXXVI—164.

Essential facts indicated in title. Patient seen twenty years after last operation, tumor had disappeared, but nasal septum was bent to the left, there was large cavity in the right naris, right cheek was prominent, and right eye blinded.

SARCOMA ORIGINATING IN THE FLOOR OF THE RIGHT MAXILLARY
ANTRUM TWO YEARS AFTER OPERATION.

Waggett, E. B. Royal Soc. Med. Proc., 7; Laryngol. Sect.,
1913-14, 189.

Growth involved left antrum, nose and hard palate; operation, free removal; no recurrence in three years.

CASE OF SPINDLE CELL SARCOMA OF THE ACCESSORY SINUSES.

Canfield, R. B. Journ. Mich. Med. Soc., 1915—XIV—523.

One case that had been operated intranasally without relief; large growth in nasal sinuses removed by radical operation. Good operative result; no later report.

SARCOMA OF THE NASOPHARYNX.

Dorr, R. C. Southern Med. Journ., 1915—VIII—233.

Giant cell sarcoma in young girl; tumor removed without radical operation; several recurrences, removed in similar way; since last operation no recurrence for "nearly two years." Patient's general health excellent.

SPINDLE CELL SARCOMA OF THE NASOPHARYNX.

Orton, H. B. Laryngoscope, 1915—XXV—709.

Operated with temporary improvement; recurrence of symptoms and treatment with Coley's serum, resulting in disappearance of nasal tumor and reduction in size of glands in the neck.

PRIMÄRES LYMPHOSARKOM DES NASENRACHENS.

Oppikofer, E. Cor. Bl. f. schweiz Aerzte, 1916—XI.VI—1177.

Reports two cases of lymphosarcoma of the postnasal space. (1) Man, 72 years old; operated; recurrence and death two years later due to apoplexy, not the tumor.

(2) A man 40 years old; several recurrences and operations; final operation followed by large doses of arsenic; no recurrence in seven years.

Also mentions one other case of round cell sarcoma operated; arsenic treatment; recurrence and death from pneumonia in a year.

SARCOMA OF THE RIGHT MAXILLARY ANTRUM. MOURE'S OPERATION.

Moore, L. Royal Soc. Med. Proc. 10; Sect. Laryngol., 1916-17, 29.

Sarcoma originated from right ethmoid region; Moure's operation; report six weeks after operation, nose clean and healthy.

ROUND CELLED SARCOMA OF RIGHT MAXILLARY ANTRUM, ETHMOID AND NASAL CAVITY. MOURE'S OPERATION.

Thomson, St. C. Royal Soc. Med. Proc. 10; Sect. Laryngol., 1916-17—58.

Author says: Removal "may be incomplete," but the single incision gives great advantage. Report two months after operation, no recurrence.

SARCOMA OF THE NASAL SEPTUM.

Goldstein, M. A. Ann. Otol., Rhinol. and Laryngol., 1917—XXVI—1146. Also in Am. Laryngol. Assoc. Trans., 1917—XXXV—263.

One case; operated; recurrence after one month.

CASE REPORTS.

1904 TO DATE.

II. CASE TREATED BY RADIUM, X-RAY, ETC.

(ARRANGED TO DATE.)

TWO CASES OF SARCOMA.

Riddell, J. R. Glasgow Med. J., 1905—LXIV—280.

One case sarcoma of nose (left nostril); treated with X-rays until tumor was reduced in size about one-half (September 1 to November 10, 1902). Remainder of growth removed (April, 1903); stump treated with X-rays till August 15, 1903. Patient dismissed cured. No later report.

One case sarcoma of nasopharynx ("occupying whole post-nasal space"). Treatment with X-rays began on June 7, 1904,

and continued until June 10, 1905. No attempt at removal, but small piece taken for diagnosis. "The case appears to be well."

CASE OF INTRANASAL SARCOMA.

Aufmwasser, H. *Laryngoscope*, 1908—XVIII—658.

One case sarcoma of nose, repeated recurrences after intranasal operation; after removal by snare and curette in March, 1904, patient was given X-ray treatment; another recurrence in September, 1904, removed intranasally, followed by X-ray for two weeks every other day. No further trouble. General health good and no symptoms of recurrence, November 1, 1901—three years.

TREATMENT OF SARCOMA OF THE NASOPHARYNX BY INJECTIONS OF ADRENALIN.

Rhodes, J. E. *J. Am. M. Ass.*, 1906—XLVII—430. Also in *Am. Laryngol. Assoc. Trans.* 1906, 173, and in *Ann Otol., Rhinol. and Laryngol.*, 1906—XV—444.

Reports one case of sarcoma of the nasopharynx treated by injection of adrenalin; sarcomatous mass was reduced in size and pain alleviated. In spite of local improvement, patient died of general weakness and toxemia. Author recommends this method for inoperable cases only, as a palliative measure, not as a cure.

This case is included in Farrell's summary, 1911. (See *General Discussions and Collections of Cases.*)

NASAL SARCOMA.

Chappell, W. F. *Am. Laryngol. Assoc. Trans.*, 1912—XXXIV—286.

Report of a case that improved temporarily with use of Coley's serum; after temporary improvement tumor began again to enlarge; a mastoiditis intervened and was operated. Marked improvement was noted after this, tumor disappearing almost entirely. "It has been suggested that during his attack of suppurative mastoiditis a vaccine was manufactured which, in part, destroyed the growth." A few months later

tonsils and adenoids were removed, and the patient's general condition was not so good. Symptoms indicated that the nasal growth had increased in size. No further report.

SARCOMÉ NASOPHARYNGIEN GUÉRI PAR L'ÉLECTROCUPROL.

Jacques. *Rev. méd. d. l'Esnt.*, 1913—XLV—407.

Reports one case of sarcoma of the nasopharynx operated, in which tumor recurred and was treated by twelve gluteal injections of colloidal copper. After the twelfth treatment the tumor had entirely disappeared, leaving only a scar at the site of the operation. No later report.

CASE OF SARCOMA OF THE NASOPHARYNX TREATED BY RADIUM EMANATIONS.

Hastings, S. *Royal Soc. Med. Proc.* 7; *Laryngol. Sect.*, 1913-14—33.

Sarcoma filled nasopharynx. Tube equal to 82 mg. radium bromide inserted through a small incision in soft palate, left in place sixteen hours. Symptoms improved in five days. Treatment on August 25, 1913; patient well; no sign of growth and slight scars December 5, 1913.

CASE OF SARCOMA OF THE NASOPHARYNX TREATED BY RADIUM EMANATIONS.

Martineau, A. J. *Royal Soc. Med. Proc.* 7; *Laryngol. Sec.*, 1913-14, 32.

Tumor on left side of nasopharynx. Four X-ray treatments previously. Tube of radium (= 47 mg.) inserted through nose retained 24 hours. Growth diminished in four or five days. About two months later no visible growth and surface healed.

CASE OF SARCOMA OF THE NASOPHARYNX TREATED BY RADIUM EMANATIONS.

Tilley, H. *Royal Soc. Med. Proc.* 7; *Laryngol. Sect.*, 1913-14, 31.

The tumor filled the nasopharynx. Two radium emanation capsules each containing equivalent to 40 mg. radium bromid

inserted into anterior surface of growth, left for 24 hours. Whole mass disappeared in a week. In a month patient feeling well; only one small gland palpable under left ramus of jaw.

In the discussion Dr. Tilley says that he did not claim that the case was "cured" but six weeks before the case seemed hopeless, while at the time of the report "anyone might think he was normal." He did not think such a result could be obtained by any other method.

SARCOMA OF NASOPHARYNX.

Patterson, N. Royal Soc. Med. Proc. 9; Laryngol. Sect., 1915-16, 61.

One case, six X-ray treatments through mouth, tumor disappeared, but later radium applied through postnasal space, X-ray applications to neck; also operations on enlarged glands followed by X-ray. Last treatment July 29, 1914. February, 1915, no signs of recurrence.

SARCOMA OF THE NASOPHARYNX.

Lewis, A. C. J. Tenn. Med. Assoc., 1916-17—IX—461.

Reports one case sent to Johns Hopkins Hospital for radium treatment, improvement reported, "with a good chance of recovery."

CASE OF NASAL SARCOMA CURED BY RADIUM.

Stein, O. J. Illinois M. J., 1917—XXXII—299. Also Ann. Otol., Rhinol. and Laryngol., 1917—XXVI—782, 892.

Sarcoma originating from right ethmoid region; treated by radium; patient died a few weeks after last examination from perforated appendix; autopsy showed no sign of tumor in the nose or nasopharynx and no metastasis.

Dosage: First dose, 100 milligrams of radium applied for five hours on three consecutive days; nineteen days later same amount for six hours each day; thirty days later, 50 milligrams for four hours; sixty days later, 50 milligrams for six hours, on two consecutive days. Radium also applied to large glands on side of neck.

In the discussion Dr. Woelfel claimed that sarcoma of the upper air passages is peculiarly susceptible to radium, but did not report any cases.

SARCOMA OF THE ETHMOID.

Moschowitz, A. V. *Ann. Surg.*, 1918—LXVII—67, 621.

Author reports two cases of sarcoma of the ethmoid operated; results excellent; no recurrence in sixteen months in one case, in "almost a year" in the second case. In the discussion, Dr. Green reported a case of sarcoma arising on the horizontal plate in the frontal bone on the right side; operation; same condition on left side in a few months; operation; recurrence on right side; deep X-ray treatment; tumor decreased in size, but toxemia caused death.

Dr. Meyer reported a case of Dr. Pfahler's, sarcoma of the orbit, treated by X-ray; tumor much decreased in size, eyeball receded and vision good.

XLIV.

A NEW TONSILLECTOMY TECHNIC

BY BERTRAM C. DAVIES, M. D.,

LOS ANGELES.

There are three requisites necessary for a successful technic for tonsillectomy: 1. There must be no damage to the pillars or contiguous tissues, avoiding thereby unnecessary hemorrhage and deformity; 2. The tonsil removal must be complete; 3. The time required must be short, obviating shock, which is important, especially in children.

A technic based on anatomic relations which covers these three requisites will satisfy every requirement. With these considerations in view, and disregarding the mechanical devices intended to remove all dangers and difficulties of the operation, the writer dares to offer a very simple, safe and uniformly effective technic, which his own experience with that of others has proved satisfactory.

The instruments necessary are: Mouth gag, tongue depressor, tonsil tenaculum, scissors tonsil snare, sponge holder. The technic is based on the attachment of the tonsil to the pillars. Loeb says: "The tonsil is surrounded by the pharyngeal aponeurosis which is rather loosely associated with the capsule." Next to this is found the superior constrictor muscle, the invasion of which together with the pillars accounts for so many so-called adhesions.

The separation of the tonsil from the pillar, because of its loose attachment, does not require the use of a sharp instrument; it is accomplished much more easily when perfect control of a semisharp instrument can be maintained. The writer has therefore utilized a pair of Seiler's turbinal scissors in which the backs of the blades have been beveled to a semisharp condition so as to produce a more than dull dissection without cutting.

In children and nervous adults, the gag is adjusted under general anesthesia, the tongue depressed and the tonsil grasped with the tenaculum, the upper blade being passed well over the

superior pole of the tonsil, the lower blade being passed well down under the inferior pole, and the instrument closed. The tenaculum handle is then pressed over into the opposite angle of the mouth, at the same time making slight traction forward and toward the median line. The tongue depressor may now be dispensed with, the tenaculum handle serving this purpose. The anterior pillar is now on the stretch over the tonsil, the entire outline of the organ being visible.

The scissors are now introduced (Fig. 1), the points, blades closed, passing between pillar and capsule at their junction in the upper third. In this position the points are passed outward to the base of the tonsil, no force being necessary and then opened about one-half inch, from which position the lower blade being fixed, the upper blade is made to travel over the top of the tonsil, describing an arc extending down one-third of the posterior pillar.

The scissors are now closed, being held in position, and the lower blade moved downward, while the upper blade is fixed at a point on a level with the inferior pole of the tonsil. (Fig. 2.)

Exercise at this time of slightly increased traction inward and forward will "deliver" the tonsil, and it now stands out of its fossa and anterior to the anterior pillar. The snare is adjusted and the entire tonsil is easily and quickly removed, carrying with it nothing but its own capsule and leaving a shining and uninjured aponeurosis.

The operation is rapid and in a large proportion of cases practically bloodless, sponging in the hands of the writer being rarely required.

Under local anesthesia (novocain, 1 per cent, injected between capsule and pillars) this particular technic renders the operation painless, with a minimum of postoperative pain and tissue reaction.

The first step in the technic, that of beginning the dissection, is of much value to open a peritonsillar abscess, being practically always effective in locating the pus cavity. There is no laceration of tissue, as in incising the pillar several times in the endeavor to strike pus and a subsequent tonsillectomy is not complicated by consequent adhesion between the capsule and the pillar.

It is true this technic approximates the average dull dissection, but the substitution of the scissors, altered as described, together with added manipulation of the tenaculum, makes it much easier and quicker.

The technic renders unnecessary the purchase of a new instrument of more or less doubtful value, but is accomplished with such instruments as the average otolaryngologist has in his case.

No assistant is necessary, the instruments are few and no interchange is made during the operation.



Figure 1.



Figure 2.



XLV.

TUBERCULOMATA OF THE LARYNX.

By J. A. PRATT, M. D., F. A. C. S.,

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UNIVERSITY OF MINNESOTA.

Tuberculous tumors of the larynx are one of our rarest of tubercular manifestations. They are generally situated in the ventricles, but can be found on other parts of the vocal box. The patient first presents himself to be relieved of hoarseness and complains of little else, even when the tumors are very large, as in the case reported. The physical signs of tuberculosis are usually absent, if the patient is seen in the beginning hoarse stage and the diagnosis is made with the microscope.

The picture of the one I have seen reported and the one I am reporting were very similar. The tumors were of the lobular variety, growing from the ventricles on each side, not interfering with the cords or rim of the glottis, and of a smooth, brittle, nonulcerating type. Neither case showed any physical signs of tuberculosis at the time the diagnosis was made.

Mr. M. M., age 28, came to the office September 19, 1918, complaining of laryngeal trouble, slight dyspnea, hoarseness but practically no pain. There was free movement of the larynx and no enlargements of the lymph glands. Upon examination nearly all the epiglottis was gone and the edges healed. The larynx above the cords was filled with seemingly four growths attached to the ventricles and nearly reaching to the center. These growths were slightly rough, pale in color, and cartilaginous to the touch and brittle, as was demonstrated when a piece was removed for examination. The patient first noticed trouble with his throat in the spring. He had his lungs examined and was pronounced negative. He worked all summer at his usual occupation of grain elevator constructor. On account of the suspicious appearance of the growths, he was returned to his physician with instruc-

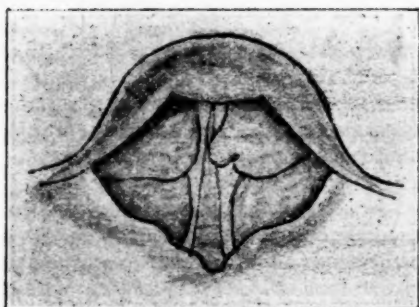
tions to have a Wassermann made and to be given an injection of neosalvarsan at once. After the neosalvarsan injection he claimed his throat never felt so well and he left for a week's fishing trip. His Wassermann was reported negative. He returned with an increase in weight of seven pounds, feeling fine and the growths seemed smaller, and where the piece was removed it was entirely healed. At this time the report came from the pathologist that the specimen submitted was tuberculous tissue and a diagnosis of tubercular tumors of the larynx made.

At this time, in October, he was presented before the Minnesota Academy, as tubercular tumors of the larynx, but the negative appearance of the patient brought forth the discussion that it might be malignant, benign, syphilitic or a combination. The patient gradually failed and died February 1, 1919, of general tuberculosis of the lungs, with large cavities.

919 METROPOLITAN BANK BLDG.

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Appearance of the larynx at the time of the original examination.



XLVI.

THE REPORT OF A CASE OF CHRONIC SUPPURATIVE OTITIS MEDIA WITH INTERESTING LABYRINTHINE SYMPTOMS AND OPERATIVE FINDINGS.*

By JOHN RANDOLPH PAGE, M. D.,
NEW YORK.

The question when is it advisable to invade the labyrinth in a radical mastoid operation has prompted the following case report with a few brief references.

On August 26, 1919, a boy nine years of age was brought to Dr. Duel's clinic at the Manhattan Eye, Ear and Throat Hospital complaining of headache, dizziness, vomiting and pain in his right ear. He looked sick and emaciated and had a tendency to fall to the right when he attempted to walk alone.

Beyond noting a foul discharge through a low central perforation in the drum membrane of his right ear, nystagmus to the right and total loss of hearing in the ear, no further examination at this time was made. He was admitted for observation as a case of "O. M. P. C.," mastoiditis and acute labyrinthitis," and strict orders were given for rest in bed and cleansing of the ear with as little disturbance to him as possible.

The history obtained was that since an attack of scarlet fever three years before he had had an intermittent discharge from the right ear, that four weeks before, at a time when there was no discharge from the ear, pain had developed, and when he turned his head from right to left he felt dizzy and would frequently vomit. This occurred several times a day, so he was treated for stomach trouble by his family physician until he was brought to the hospital because of the discharge from the ear which had developed with a recurrence of pain only four days before. His temperature on admission was

*Read before the American Otological Society in Boston, Monday, May 31, 1920.

normal, the leucocyte count 9600 with 66 per cent polynuclear neutrophiles. Within twenty-four hours his pain had left and his symptoms had so far subsided that it was difficult to keep him in bed, although the nystagmus still persisted and on sitting up he was unsteady. He did not vomit after his first night in the hospital, and after eight days of normal temperature he gradually regained his equilibrium and was allowed to go home with instructions to return in six weeks for operation on the diseased mastoid.

The tests at this time showed a completely dead labyrinth except that there was still a slight nystagmus to the diseased ear, a Weber to that side and a slight indefinite disturbance on suction in the fistula test but none on compression. Irrigation of the ear with ice water for five minutes produced no effect, and the noise apparatus revealed total deafness.

On his return seven weeks later, with the noise apparatus in his good ear, he heard a moderately loud voice at arm's length, had a slow but positive caloric reaction in one minute and twenty-four seconds, his Weber lateralized to the right or diseased ear, and the House Surgeon recorded after rotation to the right in the horizontal plane an after nystagmus of 16 seconds, and on rotation to left an after nystagmus of 26 seconds, which seems likely to have been an error of record and the reverse to have been the case.

The condition in the tympanum warranted a radical mastoid operation, which when performed revealed a mass of cholesteatoma over the horizontal canal and region of the oval window. The crest of the canal was eroded but it could not be definitely determined, without the dangerous use of a probe, whether or not a fistula existed, though slight pressure with moist cotton pledgets over this area caused no movement of the eye. Because of the excellent function, further interference in this locality was carefully avoided. On removing the cholesteatoma from the region of the oval window its membrane was seen to follow the surface of the inner tympanic wall in its upper posterior part and dip into the oval window recess leaving the stapes plainly in view. In demonstrating this to some students the capitulum was touched with a small probe and the bone fell over loosely, intact but not completely dislocated, leaving its seat in the window covered with the

white membrane of the cholesteatoma. The dangerous communication with the labyrinth that is usually established by such an accident was in this case prevented by the disease. No disturbance whatever of the labyrinth was noticed and the next day the hearing was noticeably improved and the caloric response to a cold solution was active and almost immediate. An uneventful recovery, with a thinly dermatized and dry middle ear cavity, was obtained.

Examination on April 3, 1920, after an absence of several months, showed no accumulation of epithelium in a cavity that was perfectly dry with the oval window in plain view.

Functional test was as follows:

Weber referred to the right (operated) ear.

Rinne negative in right ear, positive in left ear.

Bone conduction increased in right ear, slightly increased in left ear.

Lower tone limit, 38 d. v. in right ear, 26 d. v. in left ear.

The 2048 fork was heard equally well in both ears but about 2 seconds minus in both.

The upper tone limit was $1\frac{1}{2}$ Galton in both ears.

Acoumeter 3 ft. in right ear, 15 ft. in left ear.

Whisper (numbers) 15 ft. in right ear, 25 ft. in left ear.

Whisper (confusing words such as "telephone" followed by "thirty-four" 4 ft. in right ear.

With the noise apparatus in left ear, he heard a moderately loud voice at 30 ft. in right ear.

Rotation to right after nystagmus 30 seconds.

Rotation to left after nystagmus 26 seconds.

After the skin over the oval window was softened with oil, hearing for the acoumeter improved from 3 to 6 feet and whisper from 15 to 31 feet.

Had this case been operated on shortly after the acute symptoms of labyrinthitis had subsided, say two weeks after, when the caloric test was negative and the hearing absent, the dictum (made in Germany) that a radical mastoid operation should not be performed on an ear with a dead labyrinth without the labyrinth itself being opened to provide an outlet for any inflammatory effusion that might be set up within it by the traumatism of the operation would very likely have influenced us to open the vestibule and cochlea, particularly

when we considered the erosion of the horizontal semicircular canal, as this is what we did do in a similar case where the hearing and caloric reaction had not returned after the acute labyrinthitis had subsided.

Would the hearing in this similar case have returned if we had waited longer, or had in operating confined ourselves to the middle ear and mastoid? I think not, for while in both cases there was total loss of hearing and caloric reaction there was in the subject of this report along with the total deafness and negative caloric still a nystagmus to the diseased ear and a slight disturbance on suction in the fistula test, which was not the case with the previous patient, and which emphasizes the importance of not omitting these tests. The Weber also was lateralized to the diseased ear, but it will be recalled that Richards had a case in which the Weber was lateralized to the side on which the labyrinth had been removed.

In regard to the dictum referred to, some respect is lent to it by two cases of Dr. Kerrison which in his absence came under my care. Both had dead labyrinths and the radical mastoid operation had been performed on both without the labyrinths being opened. Tests had shown them to be functionally dead but at operation there was nothing found in either case to lead one into the labyrinth, so neither labyrinth was opened. Neither cavity showed any inclination to dermatize despite careful dressing, and in one case re-operation. This case later developed a cerebellar abscess and died. The other disappeared, probably discouraged by the prolonged delay in healing.

In the three labyrinth cases referred to by Dr. Bowers before the New York Academy of Medicine, Section on Otology, March, 1920, all of which were acute, he operated on two before the labyrinthine symptoms had subsided, opening the labyrinth in one and doing a simple mastoid on the other, the third he let alone, which in our opinion is what he should have done in all three cases, at least until the acute labyrinthine symptoms had subsided and time had been allowed for the communications with the meninges to become sealed off. This also is his subsequent opinion in regard to his first case, for obviously all possibility for the return of hearing in it was destroyed by the operation on the labyrinth, yet this labyrinth

was no more dead to sound or caloric stimulation than was the one in the subject of this report in which both functions returned. Reference to the other tests was not made in his case except to say that the labyrinth did not respond to stimulation.

Neither Dr. Dench nor Dr. Richards (John D.) have been influenced by the German dictum. The former is not impressed by the suggestion that latent infection exists in a labyrinth forever simply because it is dead functionally; and the latter is convinced after opening several dead labyrinths of long standing that while they remain functionally dead the communication between them and the meningeal fluid often becomes reestablished and no macroscopic difference in the appearance of the dead and the normal labyrinth can be detected on opening them.

The conclusions reached are that aside from a myringotomy, where it is necessary, operative interference in cases of acute labyrinthitis is contraindicated until the acute symptoms have subsided, except in extraordinary cases where other symptoms have developed which necessitate operation on the mastoid or sinus, or where in beginning meningitis it is thought advisable to sacrifice all hope of returning function to the advisability of promoting drainage through the labyrinth.

And secondly, since we are unable to determine whether an attack of labyrinthitis is of a serous or purulent nature, no prognosis regarding the return of function can be made until ample time for its return has been allowed. And further, in cases of chronic purulent otitis media which require operation in the presence of a dead labyrinth the decision whether or not to open the labyrinth depends on the exigencies of each individual case, and while one may be led to open the labyrinth by disease of its wall, or by the history of a comparatively recent attack of presumably purulent inflammation which may have sealed off the communications with the meninges but left the vestibule and cochlea full of pus, he may on the other hand, in a case of long standing, by invading the labyrinth, open a cavity that has long since ceased to be a menace, and thereby unnecessarily open an avenue for infection of the meninges.

127 EAST SIXTY-SECOND ST.

XLVII.

DIRECT LARYNGOSCOPY.*

BY STANTON A. FRIEDBERG, M. D.,

CHICAGO.

In any special technical procedure, the field of work in so far as definite indications are concerned, is more or less limited. This may account for the fact that the practical value of direct laryngoscopy has not been accorded the recognition it deserves. When we stop to consider that it is the only method whereby a satisfactory view of the larynx may be obtained in infants and children, it is difficult to understand why it has not been more universally adopted. To one who has acquired the necessary technic and skill, the procedure is less difficult than the attempt to obtain a view of the larynx in a frightened and struggling child. Even though a mirror could be introduced, the peculiarities of the epiglottis with its flaccidity and tendency to curl, often prevents more than a glimpse of a limited part of the larynx. Furthermore, when general anesthesia is used in indirect laryngoscopy the result is apt to be quite as unsatisfactory and, in addition, the increased element of danger must be taken into consideration. The direct method, by which the epiglottis may be held away from the laryngeal aperture gives a more extensive view with a better comprehension of the diameters and proportions of the larynx than one can obtain from the image reflected in the mirror. Furthermore, the examination can be carried out without anesthesia, either general or local.

Indications: Any laryngeal or tracheal condition of obscure or uncertain origin or development is sufficient to warrant a direct examination. In a few instances, more particularly in the accidents due to foreign bodies, a history of etiologic value may be obtained. In general, however, attention is directed to the larynx by the symptoms of hoarseness or com-

*Read before the Chicago Laryngological and Otological Society, October 6, 1919, in a Symposium on Indirect, Direct and Suspension Laryngoscopy.

plete aphonia of either gradual or sudden onset. There will be cough, stridor or dyspnea of varying degrees. Pain, difficulty in swallowing and certain constitutional symptoms may also be present. Any one or a number of these symptoms may be due to a foreign body, perichondritis, papillomata, congenital or acquired stenoses, malformations, supraglottic or subglottic edema or infiltration, membrane formation, abscess or traumatism. It is not uncommon for a number of these conditions to be diagnosed under the comprehensive term of croup. With others, diphtheria is suspected and antitoxin administered without any resulting benefit. Whenever there is any reason for doubt, a culture, uncontaminated by oral secretions, may be made directly from the larynx and trachea.

In addition to the aid in diagnosis, the direct method offers unequaled facilities for certain operative procedures. As an aid in the introduction of the bronchoscope, it is indispensable. In conjunction with smaller sized endoscopes, it has made it possible to do bronchoscopy by the upper route in the youngest of patients. The removal of foreign bodies above, between or below the vocal cords, may be done under direct vision, thus obviating the dangers of traumatism or of forcing the offending substance deeper into the air passages. Papillomata and granulations may be cauterized or removed, stenoses dilated and treatment applied to areas of ulceration. Intubation and extubation may be done quite satisfactorily under the guidance of the eye. The former, however, is not any more easily performed by this method than in the ordinary way. In extubation, it is much more advantageous. The writer has, on several occasions, removed intubation tubes that had been forced into the trachea in the attempt at extraction in the usual manner. In the relief of this accident, the only recourse formerly was opening the trachea. A comparison of the two procedures strikingly emphasises the value of the direct method.

Contraindications: Although there are no absolute contraindications, certain conditions will require the exercise of extreme caution in making the examination. Chief among these are high grade dyspnea, uncompensated heart lesions, myocarditis and extreme weakness due to prolonged respiratory obstruction. In the markedly dyspneic patients, it is safer

to perform tracheotomy and then make the direct examination. In some patients, depending upon the cause and nature of the obstruction, the insertion of a bronchoscopic tube through and beyond the swollen area may bring about relief. It cannot be too strongly emphasized that no attempt should be made to examine a highly dyspneic patient unless complete preparations have been made for bronchoscopy and tracheotomy.

The direct method may be extremely difficult or impossible to carry out in ankylosis of the jaws and possibly in some deformities of the cervical spine. Alveolar, peritonsillar, or retropharyngeal abscess may also temporarily prevent an examination.

Technic: The picture obtained by the direct method of examination is entirely different from that which is ordinarily seen in the mirror. The color, size, general perspective and relationship of the parts of the larynx do not conform to the descriptions as found in text books on laryngology. This apparent lack of agreement is due to the fact that almost all that has been written concerning the larynx was based upon the image as it appeared in the mirror. Unless one is familiar with the natural difference between the indirect and direct view, an examination will be unsatisfactory and the conclusions drawn quite likely will be incorrect.

Certain landmarks must be recognized and their relationship to the surrounding structures fully appreciated in order to avoid dangerous bungling. One of the most important guides is the epiglottis. Ordinarily the recognition of this structure would not be considered difficult but, in infants, it is pale, very small and soft, difficult to hold and is quite easily displaced. This displacement is favored by the mobility of the adjacent structures. Difficulty in recognition will also be increased by the presence of an excess of secretion, and also by movements of the throat due to gagging and coughing. Some help may be obtained in older children by having the tongue held out, thus elevating the epiglottis and bringing it more readily into view. The rounded eminences of the arytenoid cartilages are the next important landmarks. Inflammatory conditions will at times make them difficult of recognition. The aryepiglottic folds, vocal cords and glottic lumen

are not of any assistance as guides until the epiglottis is held away from the laryngeal aperture and the usual spasm of the muscles of the larynx subsides. After the arytenoid cartilages have been defined, the posterior commissure may be recognized and the mucous membrane inspected down to the upper portion of the posterior wall of the trachea.

Children should be examined in the recumbent position. The head should be held and prevented from rotating by a capable assistant. Movements of the trunk and limbs should be controlled by another assistant or nurse. The tip of the laryngeal speculum is introduced and carried downward over the base of the tongue. For ordinary examinations, the speculum may be held in the right hand. It is highly necessary that equal proficiency in its introduction be acquired with either hand. This is especially the case where operative manipulations require the free and unlimited use of the right hand. Changing from one hand to the other while the speculum is in place will usually allow the epiglottis to slip away from the end of the instrument. The necessary readjustment will add just that much more time to the examination. Furthermore, if there is any inflammatory condition involving the supraglottic area, this will undoubtedly be increased by the additional instrumental manipulation. Adults may be examined either in the upright or recumbent position. However, in suspected foreign body cases, the latter is much the safer as it permits the head, neck and trunk to be placed in a downward inclined plane. In case the foreign body is dislodged, it is then less likely to enter a lower part of the respiratory

After the tip of the epiglottis has been recognized, the end tract or esophagus.

of the speculum is passed over its upper margin and then, with a lifting motion, slightly downward over its laryngeal surface. The depth to which it is passed necessarily will vary according to the age of the patient and the size of the epiglottis. In general, just enough of the tip should be held to prevent the epiglottis from slipping away. This will allow the prominences of the arytenoid cartilages to come into view. If the end of the instrument is introduced too far downward the arytenoids will be overridden and the pyriform sinuses and mouth of the esophagus entered. Having exposed the aryte-

noid landmarks, the tip of the speculum is carried a little farther downward along the surface of the epiglottis at the same time increasing the pressure upward. This elevates the base of the tongue, the hyoid bone and its attached muscles and produces a wider exposure of the laryngeal aperture. The posterior commissure may be recognized, the false cords, and after a moment or two, allowing the laryngeal spasm to subside, the glottic lumen and the true cords. On deep inspiration the rings and posterior wall of the trachea may be seen sometimes as far down as the bifurcation.

The anterior portion of the larynx, especially the commissure, is the most difficult to bring into view. Slight changes in the position of the head combined with external pressure over the thyroid cartilage will be sufficient in most instances to expose this region.

During the introduction of the speculum, the upper lip should be held out of the way to prevent it from being caught between the instrument and the teeth. Pressure against the latter must be avoided, as nothing is accomplished thereby and injury to the teeth is apt to be the result. For the exposure of the larynx, the only pressure or lifting force of value or consequence is that which is derived from the end of the speculum directed against the displaceable soft parts. In the recumbent position the force is directed upward. With the patient seated, the direction of pressure is forward. Any unusual difficulty in exposing the larynx may, as a rule, be traced to an incorrect position of the head. For the ordinary examination anesthesia in children, either general or local, is usually unnecessary. It increases the time, introduces an additional element of danger and offers no advantage in so far as the position and control of the patient are concerned. In adults in all but a few patients, a local anesthetic will suffice.

Owing to the size of the larynx in very young patients, carefulness and gentleness are required in order to avoid traumatism. This caution is more than ever necessary if any obstruction to respiration will produce an edema. In order to lessen the danger of increasing the swelling or congestion of the supraglottic structures, the writer has varied the usual procedure in exposing the larynx. Instead of holding the tip of the epiglottis with the end of the speculum, the latter is in-

serted deeply into the space between the base of the tongue and the epiglottis. By exerting the required lifting force upon the tongue the epiglottis, by reason of its attachments to the latter, is placed on the stretch and is pulled away from the laryngeal opening as the tongue is moved upward. Not only is it possible to obtain quite a satisfactory view of the larynx but the bronchoscope may be introduced with the same facility as in the other method. The only advantage in exposing the larynx in this manner lies in the avoidance of traumatism to the supraglottic structures already involved in an inflammatory reaction or in an edema.

It is hardly possible to compare the simple direct with the suspension method of laryngoscopy. The latter supplements the former. For the introduction of the bronchoscope and for diagnoses in children, the simple method meets practically every indication as it is possible to carry out the procedure quickly and without anesthesia. It will also be satisfactory in certain operative procedures. Where a prolonged operation is necessary and where the free use of both hands is required, the suspension method must be the method of choice.

XLVIII.

SUSPENSION LARYNGOSCOPY AS A MEANS OF
DIAGNOSTIC AND OPERATIVE APPROACH
TO THE LARYNX.*

BY R. C. LYNCH, M. D.,
NEW ORLEANS.

It has been just five years since my first introduction to you upon this floor when your chairman so graciously extended to me that privilege; two years later, I happened in at one of your meetings and again took part in your proceedings. It is, I assure you, a real pleasure to come this time deliberately for the purpose of taking part in the symposium which your chairman has so considerably arranged, and I wish to take this opportunity of extending my sincerest thanks to each of you for this privilege.

I have discussed suspension laryngoscopy from many stand-points and I have begun to feel that the subject was about exhausted and it was on this account only that I expressed some doubt that the subject was about worn out; but, when your chairman proposed this symposium, I felt that it would be an opportunity to exchange our views and gather the proper fields and limitations of each department, and this more so because of the splendid atmosphere which I know from the past prevails among you.

Suspension laryngoscopy as a diagnostic means of approach to the larynx has its field of usefulness without doubt; but on account of the necessity for its use, one readily understands that it has no place as a routine procedure; but, by its use certain data can be gathered which furnish that refined type of information that leads to most accurate diagnosis. This cannot but help in the more complete and ultimate care of the special condition under observation. For instance, in the diagnosis of tumors, suspension permits the two handed palpation carried out in a manner as delicately and accurately

*Read before the Chicago Otolaryngological Society, Oct. 6, 1919.

as if the larynx were laid upon the surface of the body. While color, vascularity and probable point of attachment can be seen by mirror and spatula, it takes in most instances two hands to gain accurately the size, consistency, and actual point of origin of the tumor mass; and, in the case of large benign tumors and especially the malignant tumors, the extent of involvement and amount of induration can only be determined under two-handed manipulation which is afforded only by the aid of the suspension apparatus.

Points of vital interest to the surgeon in determining the type of operative procedure best suited for the case are also determined by this means; as an example: A fat Italian woman was examined on account of hoarseness from which she had suffered for many years. With a mirror one saw the typical picture of small fibromata at the nodal points on both vocal cords; they were apparently alike in consistency and point of attachment. Under suspension, however, on the left cord were found two small retention cysts occupying the superior surface of the vocal cord possibly a millimeter from its free margin. On the right cord the mass was soft and flabby, not cystic, and was seen to grow from the inferior surface of the vocal cord. On the left side the cysts were opened, the walls curetted and the sacs cauterized with trichloroacetic acid; on the right side the tumor was removed by dissection and found to be adenoma, so that the original diagnosis of fibroma was decidedly inaccurate, and the operative procedure different for the two cords.

In the instance of malignant tumors especially, is suspension most valuable. By mirror we see one-half or one-third of the larynx involved and are only privileged to look down upon the tumor from its superior surface. If the individual throat is sufficiently quiet and the psychology of the patient proper, we may even determine that possibly the subglottic space is involved. The same is true of the spatula, but under suspension, we can determine the depth of the infiltration and its mobility, and we can hold the mass aside and gain sufficient room to see the extent of involvement below the vocal cords. Furthermore by piercing the cricothyroid membrane with a small straight needle, we can accurately measure the extent of its approach to this outlet for the general sympa-

thetic involvement, and we can more accurately palpate the apparently normal side to determine its freedom or involvement; and, with all of this information only, can we best advise this patient as to the best means for his relief from this dreaded malady. If the anterior two-thirds of one vocal cord is involved in malignancy and the induration does not extend down to the perichondrium of the thyroid cartilage, then the case is suitable for removal by suspension, and I have done this successfully seven times. By this I mean without recurrence. If the arytenoid joint is involved and is fixed, it means an involvement of the perichondrium and thyrotomy is more desirable. If the anterior half of the larynx is involved and we have determined that the extension is not beyond or near to the cricothyroid membrane, this may be completely removed by suspension and without the necessity of cutting through the cartilaginous box and therefore open a way for general involvement. If the posterior half is involved, the prognosis is bad by any procedure except total extirpation and we can determine by suspension the probable induration of the esophagus. If this be involved, it is considered decidedly extrinsic and the prognosis is bad.

To determine all of this it is necessary to have two hands free to work, and the accuracy of the extent of involvement can only be appreciated after you have put it into practice. I would like to show you a specimen which illustrates these views very well. I do not believe one studies the delicate movement of the vocal cords nearly as well under suspension as by the other means, for the tension which is necessary to a proper view, while not now so great, still is too much to permit of their free movements. In infants and very young children, however, it seems more useful than the spatula because of the broader view and one can relieve the pathologic state if one is found to exist.

Suspension offers as simple a means of viewing the larynx especially in children for the acute conditions, as does the spatula. I refer particularly to the differential diagnosis of catarrhal subglottic laryngitis as against laryngeal diphtheria, and it has the additional advantage that if intervention is necessary this can be practiced most accurately under suspension.

For the diagnosis of vocal nodules and their removal if desired, especially in infants and young children, suspension is invaluable. As my experience increases, I find many more of these conditions than I had previously realized. While the upper two-thirds of the trachea is well within the view under suspension, I have had no occasion to use suspension for diagnosis here that could not be made by simpler means. It has not been my good fortune to see many tumors of the trachea. The broad field of view under suspension offers an intimate study of the function of the middle and inferior constrictors of the larynx and this is especially true during regurgitation or actual vomiting and likewise is the upper end of the esophagus well within the domain of vision and two-handed palpation. Thus ulcers, polypi, pedunculated tumors, extension of indurations, webs, tags, and the lodgment of foreign bodies are brought not only into view but can be palpated as described before. From these areas scrapings from ulcers and specimens from tumors can be taken with care and selection for further pathologic research. Under suspension the entire hypopharynx, larynx and upper end of the esophagus are not only under direct view, but open to the two-handed deliberate palpation. In the case of babies and young children the crane is not essential to perfect view and once the view is obtained, it is extremely difficult for the little patient to wriggle loose so as to interfere with the work at hand.

As a means of operative approach to the larynx and upper esophagus suspension laryngoscopy has made possible the development of the two-handed surgery of these regions. Generally speaking, it is now hardly fair to compare any one-handed operative procedure with the modern two-handed type; and, while I would not have you think for a minute that I would belittle that artistic, delicate and difficult procedure for removal of a small tumor from the cord by mirror and forceps, or by spatula and forceps, these procedures are pulling and tearing in their very nature, and their accuracy is always in question. In the hands of a selected few the accomplishments are wonderful, but time, patience, perseverance, ingenuity, and the temperamental make up of both patient and surgeon, are essential to success by these methods; while, once the patient is suspended, the two-handed surgery is simply

putting into practice those fundamental principles which every physician learns from his dissection room days to the time he finishes his surgical assistantship at the operating table.

To detail for you the accomplishments of this two-handed surgery would, I fear, be simply a repetition of my previous publications upon this subject, and yet I cannot help but illustrate its various phases and will ask you to see a little patient with me. The removal of vocal nodules in babies and young children is extremely simple. Grasp the tiny mass accurately and here you are permitted to take hold any number of times without the fear of losing the view and the small knife finishes the dissection. This is applicable to all of the benign pedunculated tumors to which the larynx is liable and the age may range from one to seventy years.

As I have said before, I have deliberately dissected malignant neoplasms from within the larynx seven times and without recurrence; the last case is about eight months ago and from that to four years.

All foreign bodies lodging within view are easily removed, better with two hands free than with one; and, the greater the impaction, the more the necessity for this procedure. Dental plates, open pins, and sharp metallic or shell pieces, are especially considered. The resulting traumatism and injury are almost nil as compared to either the use of the indirect method or direct spatula. The cautery can likewise be applied from the pin point or linear streaks to the mass destruction of Percy. In special conditions stitches can be taken as I have previously noted and plastic flaps constructed and sutured as desired.

Direct intubation is also practiced and the spatula is becoming almost essential in the passage of bronchoscopes in infants and young children; this has been discussed before. I find the suspension now of added advantage in what might be termed combined operations such as thyrotomy and suspension, or laryngectomy and suspension, with an assistant to keep the mouth clean of all secretions and to view the larynx through the mouth during thyrotomy is I assure you of decided advantage. Likewise we find it invaluable during the total extirpation of the larynx, especially to determine the upper limit of dissection and the final coaptation of suture for

the esophagus after the total removal. Approximation of parts along the line of clearance and proper suture of the wound can be accurately guarded and is of invaluable help in this step of the operation.

Finally, there is but one "if" to all of this, and that is: If in any case it is impossible to convert the line from the upper teeth to the base of the epiglottis into a straight line, then suspension is impossible and this surgery is not applicable. As your experience increases, this possibility decreases as with all technic.

XLIX.

THE LINGUAL DUCT IN THE PRODUCTION OF
PAROXYSMAL COUGH.*

By THOMAS W. LEWIS, M. D.,

CHICAGO, ILL.

The lingual duct or canal of Bochdalek is a defect of fetal development extending downward from the foramen caecum, the slight pitlike depression seen at the apex of the V formed by the rows of circumvallate papillae at the base of the tongue. This duct or canal has been recognized only to be neglected. Systematic works on anatomy dismiss it with a word, if they so much as mention it. The only monograph on the tongue which I have been able to discover devotes to it a short paragraph and attributes to it no etiologic importance in conditions affecting the tongue. Congenital cysts of the duct have been reported as well at the base of the tongue as lower in its course, but so far as I have been able to discover no other condition has been reported having its origin in the lingual duct.

In order to comprehend properly the relations of the lingual duct it is necessary to recall the development of the tongue and thyroid gland. The tongue is formed by the coalescence of three separate buds: the anterior bud, the tubercular impar, forms the dorsum of the tongue, the posterior buds form the posterior portion or base. The foramen caecum at or just posterior to the V formed by the circumvallate papillae represents the point where the three surfaces meet. From this point, early in fetal life, begins an invagination downward and forward for the formation of the thyroid gland. This bud becomes hollowed, later branches, dilates and becomes lobulated to form the developed thyroid gland. Very soon after the dilatation of the lower extremity begins, the upper part of the tube becomes closed and all trace of a canal has

*Read before the Chicago Otolaryngological Society, November 3, 1919.

disappeared, the thyroid being completely detached from the pharynx except by a fibrous cord.

That this tube may remain patent in some part of its course even until adult life is a matter of frequent observation. It may run upward as a patent canal from the isthmus of the thyroid, pointing in the midline of the neck, or on the side, or the extremity may be closed giving rise to the formation of a cyst. It may have a patent lumen without connection either with the thyroid or the surface and there may be the frequently observed duct running down from the foramen caecum. This latter condition is that with which we have to do in this paper: A duct beginning at the foramen caecum and running downward into the base of the tongue for a varying distance. Butlin, curator of the museum of pathology of the Royal College of Surgeons, reports a number of cases ranging from one to three cm. and cites a specimen in the museum which purports to extend from the foramen caecum to the isthmus of the thyroid, this specimen, however, he does not credit, believing it to be an artifact.

The cases referred to here are of interest because they had uniform symptoms evidently attributable to irritation of the lingual duct and because treatment based on this assumption invariably and promptly gave relief to very distressing conditions.

The first case which came under observation had a history of considerable interest and is referred to at some length.

Case 1. Mrs. Y., healthy, normal, with no history of interest beyond this. In the spring of 1892 she developed a cough of paroxysmal type which was very severe and very persistent, lasting several weeks. The cough was dry. No cause was found for it either in the chest or upper air passages and no relief was obtained except from doses of codein and at times morphin. At intervals, varying from a few weeks to several years, she had similar attacks lasting sometimes as long as five or six weeks. During these attacks the paroxysms of coughing were so frequent that at times it was necessary to resort to morphi n order that the patient might have sufficient sleep. In the course of one of these attacks, during a paroxysm of coughing, a rib was torn from its cartilage and the chest had to be strapped. During all of these attacks the

patient was under the care of very able attendants and at no time was any cause found for the attacks, the invariable conclusion being that the cough was simply nervous. In the spring of 1909, the patient, being otherwise perfectly normal, was suddenly conscious of an extremely foul and nauseating taste in the mouth. - She was at church at the time and was compelled to leave because of the nausea and foul taste. During the day there was repetition of the nausea and foul taste, some soreness at the base of the tongue and she began to cough. That afternoon she consulted me and after a most rigid and prolonged examination I had despaired of finding the source of any discharge in the mouth or throat, when in the act of withdrawing the mirror for the last time I noticed a mere pinpoint of white near the base of the tongue. This was wiped away and immediately reappeared and was found to emerge from the foramen caecum. A probe easily passed into the lingual duct for the distance of a full half inch. This was repeatedly done and demonstrated to the husband, himself a physician. The passage of the probe invariably induced a terrific paroxysm of coughing lasting for several minutes. By pressing downward and backward with the probe the mouth of the canal could be stretched so that the inflamed mucous membrane lining could be seen. The duct was carefully wiped out with pure carbolic acid. The patient reported marked diminution of the cough the next day and the treatment was repeated. On the day following the cough had entirely disappeared. Twice afterward the patient was seen, at intervals of six months or more, with some soreness at the base of the tongue and a recrudescence of the cough. Repetition of the treatment was invariably and promptly effective. On another occasion a seeming failure of treatment directed at the lingual duct was subsequently explained by the development of a frank pertussis which spread to the whole family.

Case 2. George Y., 17, eldest son of case 1, well developed, healthy schoolboy. While at school near Washington in the spring of 1909 developed a cough. He would begin to cough regularly about five o'clock in the morning and kept it up so persistently and intensely that he became a source of annoyance to the entire household. He was examined by several reputable men in Washington, but no cause was found for the

cough and as this still persisted he was taken out of school and kept out of doors. His condition remained in statu quo until August when he came to see me. Examination revealed a patent lingual duct of a depth of one inch. Intense coughing was induced by the passage of the probe. The duct was wiped out with carbolic acid and when he came back the next day he reported that he had slept through till nine o'clock, a luxury he had not been able to enjoy for many months. The cough was gone and has not returned.

Case 3. Katherine O'B., 35, widow, washerwoman, weight about 180. "A good fighting man" with no history of interest beyond this. For four or five months past has had a most distressing paroxysmal cough. There has been no sputum but a sense of something in her throat. The chest was negative. The throat was negative except that the foramen caecum was well marked and its margin everted and edematous. A probe passed into the duct for three-quarters of an inch. The contact of the probe produced a paroxysm of coughing which lasted for several minutes during which the eyes protruded and the conjunctivae were markedly congested. This patient, seen in the Central Free Dispensary, was examined by Dr. John Edwin Rhodes and the late Gurney E. Stubbs, both of whom concurred with the conclusion that the irritation of the duct was the cause of the cough. Unfortunately this patient did not return to the dispensary and subsequent history is lacking.

These three cases are all that I have seen with symptoms attributable to infection of the lingual duct. In addition to these I have in a routine search during the last ten years encountered six other cases into whose lingual ducts a probe might be passed for as much as half an inch, but they showed no evidence of disturbance.

Dr. August Strauch, an office associate, had in the spring of 1913, a case presenting identical conditions. A man of eighteen years had been troubled during several months with paroxysmal coughing coming on at eleven o'clock at night some time after retiring. No cause could be found for the cough and no relief was obtained. I suggested the investigation of the lingual duct and on examination a duct of some depth was found containing a plug of inspissated mucus of the

size of a hemp seed. Dr. Strauch was able to slit this duct with the electrocautery to the entire and permanent relief of his patient. This case showed, as did case 2, a regular periodicity of the paroxysms, but we are unable to establish any rational explanation of this apparent periodicity. This case was reported by Strauch in *Muench. Med. Woch.* July, 1913.

In casting about for an explanation of the relation between a focus of irritation in the lingual duct and an explosive paroxysmal cough, the glosso-pharyngeal-pneumogastric reflex seemed scarcely satisfactory. There is a more direct reflex and one that seems to present a clear explanation of this disturbance. Some filaments of the superior laryngeal nerve are distributed at the base of the tongue and are held responsible for cough in infection of the lingual tonsil. These filaments are doubtless the nerves involved in irritation of the lingual duct and give us a direct connection with the pneumogastric and the cough centre.

The conclusion seems justified that the lingual duct, hitherto neglected, may be the nidus of an infection producing a paroxysm of coughing not yielding to ordinary methods of treatment. That the duct is fairly frequently patent is evident and opportunity for infection is common.

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L.

DERMOIDS OF THE ANTERIOR MEDIASTINUM.
WITH REPORT OF A CASE.*

BY ROBERT SONNENSCHN, M. D.,

CHICAGO.

Dermoid cysts have been found in various parts of the body, from the head to the pelvis, occurring most often in the ovaries. They are characterized by having a wall of connective tissue with an inner lining of epidermislike structure; and secondly, by often containing hair. We are in this report concerned only with dermoids found in the anterior mediastinum, notably its upper portion. As will be shown later, the growth is quite rare in this locality.

The case to be reported is that of Mrs. G. I., aged thirty, housewife, American, who, seven or eight years ago, received treatment for goiter. Since that time there had been increasing difficulty in breathing, especially on exertion, or when exposed to a strong wind. At the time she presented herself the condition was most distressing, particularly at night, preventing sleep to a very considerable extent. At times a distinct wheezing was observed by the patient. The attacks of dyspnea were more frequent and more severe just before and after menstruation. Family history was negative.

Examination at this time, April, 1915, showed in the nose a septal deflection towards the left side; the pharynx and larynx appeared negative. Unfortunately, no endoscopic examination was made to note the condition of the lower trachea.

The neck showed a moderately sized, soft enlargement of the thyroid gland. Behind the sternal notch the upper end of a rounded mass could be palpated. On percussion there was dullness over the upper portion of the sternum.

The case was referred to an internist and a radiologist. The physical findings and the X-ray shadow led to the diagnosis

*Read before the Chicago Otolaryngological Society, November 3, 1919.

of the presence of a thymus, with a consequent thymic asthma. Operation was suggested by a surgeon who had also seen the case, but the patient at that time declined all interference, and I temporarily lost sight of her.

A year and a half later we learned that she had come into the good hands of Dr. Darwin B. Pond, who operated a few months after I had last seen her. I am deeply indebted to him for his kindness and courtesy in furnishing me information regarding the operation, the status one year thereafter, and last but not least, presenting me with the growth which he removed and which I take pleasure in showing you this evening.

The patient stated in a letter written one year after the operation that all her dyspnea had disappeared, and that she was perfectly well in every way. This freedom from all distress is still present, as confirmed by conversation with her husband a few months ago. It is now four and a half years since I first observed the case and it is three years since the operation was performed.

The technic of removal of the growth, as described by Dr. Pond, is that the usual elliptical incision as employed in goiter operations was made just above the clavicle. The tumor was situated slightly to the left of the median line, its upper end projecting above the sternal notch, its lower portion lying behind the sternum. Catgut sutures were used to obliterate the cavity, no drainage inserted, and the skin closed with horse hair. The patient made an uneventful recovery.

We here have the growth, which is about the size of an English walnut; it is cut open, showing a rather thick, firm wall. The contents are a mass of hairs and some sebaceouslike material. Owing to long exposure to preserving fluid, the latter has largely been washed out of the cyst.

Histologic sections were made of the wall of the tumor, which Dr. A. W. Stillians kindly examined and reported as follows: "There is a subcutaneous layer with fat, and above this connective tissue containing blood vessels but no glands; considerable round cell infiltration of the connective tissue. Above this is some abnormal squamous epithelium. There is no granular layer, but there is present an abnormal horny

layer. In the sections examined no hair follicles were seen." We thus have here a so-called dermoid cyst.

Now with reference to the occurrence of these cysts in the anterior mediastinum, Hare reported, in 1889, in a collection of 520 cases of mediastinal disease exclusive of diseases of the heart and lung, 288 cases of tumor, and of these only 10 were dermoid cysts. Hoffman, in 1896, collected 12 cases of dermoids of the anterior mediastinum. Planz, in 1896, reported 25 cases. Ekehorn, 1898, reported 29 cases and added two of his own. Christian, in 1902, collected 39 cases and reported one of his own, making a total of 40. This author has the most complete article on the subject which we have been able to find. With reference to sex, one can say that the cases are about evenly divided between male and female. The question of age has an important bearing in that most of the cases occur in young adults, between twenty and thirty years. That is to say, these figures refer to the time of death or operation, as the growth, of course, had been present since childhood, but the symptoms which called attention to the growth occurred at the ages mentioned.

As regards the etiology, Ribbert showed years ago that pieces of epidermis transplanted into the abdominal cavity often produce cysts lined with epidermis, and that bits of epidermis transplanted into subcutaneous tissue will proliferate in the split of the tissue in which they lie. Many dermoids lie in that portion of the anterior mediastinum between the upper border of the heart and the root of the neck. Just as the heart develops in the cervical region of the fetus, and later descends into the thorax, and the same is true of the thymus, so there may be a passage downward of the "anlage" of the dermoid cyst. Furthermore, the presence of the branchial clefts and the development of the thymus and thyroid from the third and fourth cleft (even though regarded as of entodermal origin), the intimate relation between the ecto- and entodermal layers, as shown by Minot, all these factors favor the misplacement of portions of the germinal layers.

Symptoms are sometimes entirely absent clinically, and the tumor is found accidentally at postmortem where the death is due to other incidental causes. When present the symptoms are most frequently referable to the respiratory tract, namely,

dyspnea with pressure on trachea or bronchus; coughs, with at times free expectoration, often with foul odor; and hemoptysis in a number of cases. The most peculiar and interesting phenomena is the coughing up of hairs reported in a number of instances, occurring at various times during the course of the disease. Rarely is there difficulty in swallowing or any pain in the chest.

Physical signs are sometimes but slight; occasionally the chest on the side of the tumor was found distinctly bulging; in a few cases the tumor appeared in the neck through the superior aperture of the thorax, and in a small number fistulæ formed between the cyst and the skin. Dullness on percussion is noted in a considerable proportion of the cases, and auscultation in the region of the cyst showed diminished or suppressed respiratory sounds.

The duration of the condition is difficult to determine, but judging from the time of onset of symptoms the period varied from one to fifteen years. The course is thus a very slow one compared with malignant disease in the same part of the body. The position of the tumor varies in that it may be either in the lower half of the thorax, between the heart and adjacent lung, near the hilum of the lung, in the lung substance itself, in the neck at the suprasternal notch, but it is most frequently found in the upper half of the anterior mediastinum, wholly or in part, immediately behind the upper portion of the sternum. In this latter locality the cyst may develop either upward toward the neck, latterly into the pleural cavity, or downward between the heart and lung, for it is prevented from going forwards by the sternum, or from spreading posteriorly by the great vessels, trachea and vertebræ. The tumor is often adherent to some of the neighboring structures, notably the lungs or pericardium, less frequently the diaphragm, chest wall or large vessels. This often renders any attempt at removal difficult or impossible. It is a fortunate fact that the cysts do not, except in rare instances, produce injury to or destruction of adjacent organs. The size of the dermoids may vary from that of a pigeon's egg to that of a child's head.

From the pathologic standpoint, dermoid cysts may be divided into three classes: First, essential dermoid cysts of

ectodermal origin. These are the ones most frequently reported, and they are unilocular, either simple or with diverticula, or occur as multilocular cysts. The walls are lined by epidermis containing as a rule hair follicles and sebaceous glands; occasionally sweat glands are present. At times the cyst wall was found to consist merely of connective tissue; in some cases bony plates, pieces of cartilage or teeth are seen in the cavity of the growth or in its wall. The second class of dermoids includes those of great complexity, derived from all three germinal layers, with the formation of rudimentary organs, and these may be regarded as teratomata. These cysts are very rare, judging by the few cases reported. The third class is that of tumors of the first two groups which are malignant in some part of their structure and form metastases in other organs. The contents of the cysts in most of the cases were a thick, greasy, semisolid material mixed with hair.

The diagnosis can, of course, only be made when portions of the contents of the dermoid are obtainable for examination, as, for example, if a fistula between the cyst and skin exists. Pathognomonic is the coughing up of hair in the case of a deeply situated thoracic tumor. A probable diagnosis can sometimes be made where there are signs in a young adult of a solid, nonpulsating mediastinal tumor, which grows slowly and shows no metastasis.

Treatment: While operative interference offers the only solution, a radical operation is often exceedingly difficult, while simple drainage usually proves ineffectual. I do not know whether X-rays or radium have been used, but doubt whether they would help.

CONCLUSIONS.

1. The origin of dermoids is a misplacement of ectodermal tissue during fetal life.
2. Dermoid cysts of the anterior mediastinum are quite rare, usually manifest themselves in early adult life, and are of rather long duration.
3. The location is usually behind the upper part of the sternum.
4. The coughing up of hair is practically pathognomonic.
5. Surgical interference is the indicated treatment.

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29 EAST MADISON ST.

LI.

THE FALLING REACTION IN ACROBATIC AVIATORS.

BY ROBERT J. HUNTER, M. D.,

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Thinking that it would be of interest to see if aviators show any change in the falling reaction after experience in the air, I have studied a few cases with that in view. The men were stimulated in the vertical canals only, as they are the ones involved in loops and tail-spins and would show the most marked change, if any.

The technic was the standard used in the Air Service; head on the clenched hands, which in turn rested on the knees. The angle quoted in the figures were made by projecting it from the center of the seat, at the back of the turning chair, to a board fastened to the head rest. As the head rest was moved up and down to adjust it for different heights the angles were not absolutely correct.

For the benefit of those not interested in otology, I might explain that stimulation of the semicircular canals by rotation causes nystagmus and a sensation of turning, after the chair is stopped. A normal man can point to an object with his eyes shut, after he has felt it, but after rotation, instead of pointing to the object, he makes an error in the direction, opposite to that in which he feels he is turning. The reactions are constant and specific for the various canals, which may be, by proper methods, individually examined. For the horizontal canals, the shoulder group of muscles is used, and the error called past pointing; for the vertical canals the back muscles are used and the error is falling to one side.

Twenty-seven men were turned; eleven were instructors in acrobatics, varying from 35 to over 600 hours of acrobatic flying. Their total flying varied from 170 to 1,800 hours, giv-

ing an average of 514 hours. Their average degree of falling was 2.9° . The least response was shown by the man who had the second longest experience and the greatest deviation was shown by a good pilot, who examined to be excused, because he had just had a tooth pulled and felt, as he expressed it, "all in."

Another group of five aviators, selected at random, was examined. Their experience in acrobatics varied from 10 to 20 hours; their hours of flying from 85 to 175, giving an average of 121 hours. Their average degree of falling was 6.7° . Eleven ground men were then examined. For most of them it was their first experience in the rotating chair. They had had very little experience in the air. One man had never been up. The most experienced had had 15 rides in the last sixteen months. The average degree of falling was 20.6° .

The difference between the experts and the untrained men was very marked and showed, without doubt, that men used to air work give less response to the falling test than ordinary men.

Rapid rotation of the body causes vertigo. We may define vertigo as a false sensing of motion. Past pointing is a physical sign of vertigo, in that the subject compensates in pointing, for the rate of movement that he feels. Thus we might conclude that the degree of past pointing may be taken as an indication of the amount of vertigo. I think that this is relatively true when the subject has not had any acrobatic experience, but where evolutions are performed frequently the subject learns to overcome the effects of vertigo and keep their equilibrium, even though they feel that they are falling or turning. We should consider the question, whether the sense organs in acrobats become accustomed, through training, to the rapid turning and no longer produce vertigo. Whirling dancers studied by Lieutenant-Colonel Eugene R. Lewis, M. C., in the investigation preparatory to his paper, all maintained, with one exception, that in spite of the fact that they had engaged in these exhibitions for many years, they always had vertigo. The one exception bumped into one of the kings, at the conclusion of his stunt, shortly after stating that he never became dizzy. These performers when examined in the turning chair had nystagmus of normal duration. The duration of after

turning nystagmus in army aviators, as reported by Fisher and Babcock (J. Am. M. Ass., March 15, 1919, and Levy, J. Am. M. Ass., March 8, 1919) is normal. Levy also notes less violent falling reaction in aviators. K. Dunlap (Air Serv. Med., U. S. A., pp. 316-318, 1919) finds that nystagmus is less after repeated turning. His work is refuted in Fisher's article. Observations by myself during the examination of several hundred expert aviators would show that nystagmus is of normal duration. Examinations of tight rope walkers by me gave normal turning reaction and nystagmus. I found a man with subnormal responses, who had formerly been a trick cyclist and who maintained that that was sufficient evidence of a normal balance sense. He had a plus four Wassermann. I could not determine from the history whether infection had occurred while he was still engaged in cycling or afterward.

I did not examine the nystagmus in the group of men quoted in the experiment, but many of these men had been examined at various times and the duration found normal. I took the man who showed the least falling reaction and noted his response to the slightest degree of rotation, accelerating speed, maintained speed, slowing speed and sudden stop, and found his responses entirely normal, to the great amusement of his fellow instructors, when they heard the "bell wether" of the stage with eleven months of exclusively acrobatic flying saying "stopped, stopped, stopped" while he was really whirling at full speed. It would have been of interest to measure the duration of vetrigo after turning in the entire group and the degree of past pointing after stimulation of the horizontal canals, but numerous duties in the field prevented me from doing so.

As past pointing is entirely a voluntary act, it appears that through training, these men have learned to ignore the excessive stimuli and sit up straight in spite of the fact that they feel that they are turning. It may be that their tactile, muscular, articular tendinous and deep sensation tracts have become highly trained and they get instant information from the seat of the chair, helping orientation. It is a common observation, in examining men for their sense of motion, that any auditory or visual stimuli will immediately help them to orient themselves and correct the false impression given by

excessive stimulation of the labyrinth. The question arises, How are we to determine that a man is normal if he fails to fall? We should rotate him ten times in twenty seconds and measure the duration of vertigo, which should be 16 to 36 seconds, having him keep the head 30° forward, eyes closed, and then rotate him with the head on the knees, five times in ten seconds, and note the presence of vertigo. We can also tell that these men are getting stimuli through, by watching them when they sit up or when they past point, and we will see a swaying to one side or a past pointing on raising the arm which is overcome on the way down.

Conclusion.—Slight falling to one side, or even the ability to sit up erect with closed eyes, after stimulation of the vertical canals by rotating the chair five times in ten seconds, or even five times in five seconds, is present in acrobatic aviators. Other individuals fall markedly to the side of rotation.

By close observation, a skilled observer can see that muscular effort is being used to overcome the tendency to fall. By timing the after-turning vertigo, we can determine that the tracts are normal.

928 N. SIXTY-THIRD ST.

LII.

A NEW OR HITHERTO UNDESCRIBED FORM OF MAXILLARY SINUSITIS.*

BY ROSS HALL SKILLERN, M. D.,

PHILADELPHIA.

Miss P., age 50, presented herself in September last with the following history:

During the early months of 1919, she contracted a severe cold in the head with swelling of the upper lip and the formation of so-called fever blisters, which were especially annoying in their persistence. Instead of the usual course, the cold continued in a more or less chronic form with occasional acute exacerbations. During March a postnasal discharge containing blood but no pus made its appearance. Later the blood became darker and more profuse, while the discharge assumed a thicker and heavier consistency but no more copious. This continued gradually changing its character until by July the expectorated blood assumed the appearance of clots resembling small pieces of liver, which occasionally were mixed with thick yellow pus. Cacosmia was never in evidence, neither was there an appreciable odor to the secretion. The discharge was always obtained via the postnasal passages; none had been expelled through the anterior nares. Headache, neuralgia or local tenderness had never been in evidence nor were other symptoms of sinus involvement particularly marked. The chief complaint of the patient was the expectoration of these liverlike clots of blood with the utmost frequency, which even made it necessary to cause their expulsion several times during the night, thereby greatly interfering with the necessary rest. On this account she had also practically abstained from social intercourse or even places of amusement, as the constant expectoration into a handkerchief had become exceedingly mortifying. It was chiefly on this account and the haunting fear of a hidden malignancy that prompted her to seek relief.

*Read at annual meeting of American Laryngological Association, May 28, 1920.

On presentation in September, no evidence of an active inflammation were present, either externally or by rhinoscopic examination. The nose appeared to be fairly normal, no traces of blood or purulent secretion in the region of the middle turbinate, or indeed elsewhere, being discernible. The nasopharyngoscope disclosed but little change in the normal mucosa and nothing to suggest the presence of a sinus involvement. The teeth were entirely negative.

As a routine measure in such cases, the Lichtwitz needle was introduced into the right maxillary sinus with a negative result, the injected saline solution returning unchanged. On needle puncture of the left antrum, however, as soon as the air was forced into the sinus there escaped an ounce or more of apparently pure unclotted blood, the quantity of which was considerably increased on lavage with the normal salt solution. No sign of pus, either granular or en masse, was present. The lining mucosa of the sinus did not appear to be greatly thickened, as the lumen of the cavity was found without difficulty by the point of the needle, and the sound made by the injected air proved without question that the point was not embedded in thickened mucosa. Irrigation was continued until the flow returned clear, after which 50 per cent alcohol with 1/2,000 bichlorid, sufficient to fill the sinus, was injected and the needle withdrawn. Bacteriologic examination of the blood showed an abundance of streptococcus hemolyticus.

The injections were continued daily, the discharge gradually losing its hemorrhagic appearance, only to assume more and more a purulent content, the total amount of secretion remaining about constant. It was therefore apparent that the irrigations were exerting little influence on the course of the disease; the character of the secretion, however, was changing from sanguinous to purulent. At the end of fifteen days, after about the same number of treatments, the blood had to all intents and purposes disappeared, leaving a thin, purulent, granular secretion, which mixed readily with the irrigating fluid and formed with it a milky appearance. The alcohol injections were continued, gradually being increased in strength until the pure 95 per cent was reached, with no apparent influence upon the infection. About this time a swelling appeared upon the septum, which rapidly developed into an ab-

scuss. This was incised and in a few days subsided, but was followed by a bloody discharge from the right side of the nose. The secretion hitherto had been entirely unilateral and confined to the left side. Needle puncture of the right antrum brought forth a large quantity of bloody fluid identical with that which had originally appeared from the opposite sinus. Previous to this, the right side had not been affected. The treatments now consisted of needle puncture and irrigation of both antra with a 3 per cent solution of hyperchlorite of soda, well diluted. The character of the secretion gradually changed to a granular milky one, diminishing greatly in amount, so that the patient experienced fairly comfortable nights and was not so annoyed by the frequent use of the handkerchief as was formerly the case. Despite this improvement and the tri-weekly irrigations, the course of the disease now appeared to become stationary so far as the character and amount of the discharge were concerned. Various strengths of alcohol and bichlorid, iodine and nitrate of silver were applied, one on one side, the other on the opposite, in order to test the comparative efficiency of each, and while at times it appeared as though a certain remedy was proving of value only to result in disappointment. The present condition of the patient is unsatisfactory in that she is fairly comfortable under biweekly treatments, but if untreated the disease shows a great tendency to revert to the hemorrhagic form.

This case is unique in my experience. The peculiar bloody discharge, unaccompanied by any subjective sign of inflammation with its tendency to diminish, but become purulent after irrigations and on noninterference to revert to its original type, is puzzling to say the least.

The advisability of a radical operation has been thoroughly discussed and finally decided upon where it is hoped by pathologic investigations the exact status of the infection will be determined.

LIII.

THROMBOSIS OF THE LATERAL SINUS WITHOUT
SEPSIS.*

BY HARRY L. BAUM, M. D.,

DENVER.

Many otologists concur in the opinion that every case of thrombosis of the lateral sinus should be subjected to the usual surgical procedure of exenteration, with or without ligation or excision of the jugular, as the symptoms and judgment of the operator may indicate. Such is undoubtedly the safe and common sense method of dealing with these cases in most of their manifestations, but it is my belief, based upon the literature and certain experience of my own, that there is a class of cases of thrombosis which can be rightly managed in a more conservative manner.

E. W. Day, in a paper read before the American Otological Society in 1915,¹ reports six cases of spontaneous cure of unrecognized thrombosis, the condition not being suspected until found accidentally during operation. One of Day's cases had a history of previous suppurations, in two the suppuration was of at least two months' duration and three were chronic. Of the six, four showed complete organization of the clot and two were partially organized. In none was there a history of symptoms referable to the sinus. He also mentions three other cases from his series, in which the distal ends of the clot had organized, a sinus abscess had formed and had broken through the necrotic sinus wall to drain into the mastoid cavity. In none of these were there sinus symptoms.

H. Friedenwald, in a paper read before the American Laryngological, Rhinological and Otological Society in 1913,² gives numerous references to similar cases from our own and foreign literature, in which nature had made a successful

*Read at the meeting of the Western Section of the American Laryngological, Rhinological and Otological Society, Denver, Colo., March 1, 1919.

attempt to organize the clot or wall off the infection. Most of these cases were discovered accidentally at operation and had shown no indications of sepsis referable to the sinus.

It seems reasonable to conclude, therefore, that sinus thrombosis per se is not necessarily an indication for radical interference, but that in cases discovered at operation, even during the active stage of the inflammation, if there have been no pyemic symptoms to lead to a suspicion of involvement of the sinus, simple drainage with thorough cleaning out of the mastoid cavity is all that is indicated. And that exenteration of the sinus with the establishing of a free flow from both ends and possibly the ligation or excision of the jugular is unnecessary, except in the presence of definite signs of sepsis.

In support of this theory I wish to present four cases managed along these lines and with successful termination in all.

Case 1.—A. W., age 36, was referred to me by Dr. Hess on March 27, 1914, with the history of having had an acute otitis two months previously, following a cold. Suppuration had continued without improvement since that time, and he had suffered much pain in the mastoid region and radiating over that side of the head. There was no history of septic attacks.

Examination: There was an acute suppuration of the right ear with much sagging of the posterior superior canal wall, so that the membrane was not visible. The mastoid was somewhat swollen and there was marked tenderness. There was no fever. Operation was advised and accepted.

Operation: A mastoid of pneumatic type was found, with extensive destruction, practically every cell being involved, and bleeding from the bone was profuse, suggesting thrombosis. The sinus was found to be uncovered for a distance of half an inch just below the knee. Removal of granulations revealed a necrotic opening into the sinus with thrombus formation. This thrombus was dislodged during inspection, and a free flow followed from the sinus. A small pad of iodoform gauze was placed over the opening, with only sufficient pressure to stop the bleeding, and the operation was completed with thorough removal of all necrotic bone, leaving a large posterior opening for drainage. Cultures from the mastoid showed streptococcus hemolyticus in pure culture.

The postoperative course was uneventful. Temperature

never exceeded 100, and healing was very satisfactory, with a dry ear and good hearing.

Case 2.—O. T., age 17, came to me on June 2, 1915, with a history of having had pain in the left ear about three months before, followed by discharge. This suppuration had continued since, with some pain in mastoid region. About one month before he began having attacks of dizziness, made worse on quick movement of the head, and sensation of falling. Had no nausea or vomiting and had never actually fallen. These sensations had stopped two days before with an increase in the amount of discharge. He had no history of septic attacks.

Examination: Acute otitis, left side. A good sized perforation was present, with granulations showing through and free discharge. Sagging of posterior and superior portion of membrane, but no sagging of posterior canal wall. Moderate amount of mastoid swelling with marked tenderness. Hears all forks well with that ear, especially by bone, though hearing somewhat subnormal. Rotation test normal, both sides. Caloric not taken. Temperature normal. Fistula test: Strongly positive, but peculiar in that the response consists of one movement only to each pressure, a definite swinging of both eyes to the right with quick return, but no repetition of the movement until further stimulation is applied. Slight vertigo, but no nausea, lasting only during the nystagmus. No spontaneous past pointing and points normally after rotation. Immediate operation advised.

Operation: A simple mastoid was done, finding extreme destruction of mastoid bone, including inner table overlying sinus, which was exposed from the knee downward for some distance, with formation of a sinus abscess within its walls at this point. The abscess was drained through the necrotic wall of the sinus, but the firm thrombi above and below were left undisturbed. The dura of the middle fossa was also exposed, but intact. No evidence of labyrinthine fistula was discovered. A wide opening for drainage was left posteriorly, with light packing. Cultures showed pure growth of streptococcus hemolyticus.

Postoperative course: The temperature never exceeded 100 and there was no nystagmus or vertigo. The ear was dry at the first dressing and the perforation healed promptly. The

fistula test was negative at the first dressing and remained so. Eventual healing was perfect and hearing excellent.

In this case it was my conclusion that the positive fistula test was due to pressure exerted on the cerebellum, especially in view of the unusual character of the nystagmus, and that the attacks of vertigo were caused by pressure of the sinus abscess on the cerebellum up to the time that it ruptured into the mastoid. This probably occurred two days before the operation, when the attacks ceased and the discharge from the ear increased. There was apparently no involvement of the labyrinthine capsule, although Ruttin describes this type of reaction as coming from the labyrinth in two of his cases.³

Case 3.—M. A., age 12, was referred by Dr. Palmer on July 2, 1918, with the following history: The left ear had been discharging for several years, and about one month before coming to me she had been quite sick, having severe vertigo and vomiting with inability to stand. A history of nystagmus was unobtainable, as she was not observed by a physician at that time. She remained in bed for a week, with gradual subsidence of these symptoms. Then, about one week before I saw her, she developed pain in the left ear with increased discharge, fever and headache. The headache was general. There was no history of chills or sweats.

Examination.—Left ear: The posterior canal wall was swollen so as to occlude the canal completely from the meatus inward. A discharge of foul pus, brownish in color, was coming from a perforation in the canal near the meatus, and a probe passed through this opening entered the middle ear along the canal wall, which was intact. There was no evidence of a tympanic membrane, although, on account of the complete closure of the canal, it was impossible to inspect the middle ear visually. The mastoid was quite tender, but there was no swelling. The fistula test was negative, there was absolute deafness and the caloric test was ineffectual on account of the swelling of the canal. There was no spontaneous past pointing, no nystagmus and no vertigo. Temperature was 102. The pus showed a very mixed infection, as was to be expected. X-ray showed entire loss of mastoid structure on that side, with normally developed pneumatic mastoid on the other.

Operation: Upon removing the external table a gush of pus occurred, liberating perhaps two drams of foul brownish pus under pressure. Enlargement of the wound of entrance revealed the fact that the cerebellar dura and lateral sinus lay immediately beneath the cortex, there being no mastoid cavity whatever. The abscess was seen to be epidural, and there was no evidence of communication with the middle ear. No effort was made to locate the antrum or aditus at this time, as her condition did not justify prolongation of the operation. The sinus was found to be thrombotic and a few drops of pus could be expressed from a small opening in its wall. This opening was enlarged carefully, but there was no evidence of communication with the cerebellum, and it was not disturbed further. The exposed dura was thickened and covered with old granulations, but intact. Inspection of the external canal showed no opening through the bony wall, the skin having been pushed up from the bone by pus coming out from the middle ear.

Her improvement following this preliminary operation was very satisfactory, and in one week it was considered safe to subject her to the final procedure, her temperature having been normal and headache gone since the first operation. Accordingly, the posterior canal wall was taken down, as in a radical mastoid, and the middle ear and aditus were exposed. There was no antrum, but a cholesteatome was found occupying the middle ear, aditus and extending upward to the dura of the middle fossa and backward to the dura of the anterior surface of the cerebellum and involving the external semicircular canal. The labyrinth operation was done and the middle ear cleaned out as in the radical, with the usual radical plastic on the canal. The posterior wound, however, was not closed completely, but was left partly open for safe drainage.

The subsequent course was uneventful. The wound healed as any radical, the posterior wound closing very promptly with little further drainage. The foul discharge persisted for some time from the middle ear, but epithelialization was complete in about six weeks and the ear was dry. There was no post-operative vertigo or nystagmus, and temperature was normal or practically so.

My conclusion in this case was that the absence of mastoid structure was due to the destruction of the mastoid at the time of the beginning of the suppurative process some years before and that the epidural abscess had been walled off in that location since that time. The labyrinth had undergone invasion comparatively recently, as indicated by the history, and was not responsible for the abscess and thrombosis, the latter being the result of direct infection through the sinus wall from the overlying abscess. The sinus had at no time given rise to septic symptoms, so far as could be ascertained from the history.

Case 4.—This case, not my own patient, I saw in consultation with Dr. Eichberg on August 30, 1915, and am indebted to him for permission to report the case. I was also present at the operation and followed the postoperative course.

Examination: H. W., age about 35, had suffered an acute otitis about five weeks before, and suppuration had persisted without diminution. There was considerable sagging of the posterior superior canal wall, so that the drum could not be seen, and the mastoid was swollen, with edema. Tenderness was marked. Temperature was 101. Discharge was not so free as it had been.

Operation: A necrotic external table was found, opening into a pneumatic mastoid almost completely destroyed. The lateral sinus was exposed for a considerable distance below the knee, as a result of extensive necrosis of the inner table, and was accidentally opened in cleaning away the necrotic bone from around it. Inspection revealed that it was completely filled with a firm thrombus, which had not broken down, and at my suggestion Dr. Eichberg left it in place and did not further disturb the sinus. The mastoid was cleaned out thoroughly and the wound drained. Recovery was uneventful, there being no signs of sepsis, the ear became entirely dry and the perforation closed.

Two of these cases were actual sinus abscesses, well walled off at both ends and without septic symptoms. In the other two the condition had not progressed to one of suppuration, and the clot may or may not have been sterile. At any rate, there was no escape of septic material into the blood stream, and in my opinion it was justifiable to allow them to remain

undisturbed as long as they were producing no symptoms. In case 1 the clot was so small that it was dislodged during inspection, or it also would have been left undisturbed.

In conclusion, I wish to make myself clear as not advocating a policy of inactivity in cases of frank sinus thrombosis with pyemia or in obscure cases where the infected sinus seems likely to be the source of high temperature or other symptoms. But in cases where there is no reason to suspect that the sinus is sending its toxins or bacteria into the blood stream it is my belief that simple drainage, if pus has formed, or leaving the clot entirely undisturbed if it has not broken down, is good surgery. Further, we must not lose sight of the fact that it is possible for the infectious process to extend after apparent healing has taken place, but this is probably no more likely in an unopened sinus than following curettement with excision, for it is necessary for a clot to form at the ends in any case, and cases of extension of the infection further along the sinus after operation have occurred very frequently.

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LIV.

AN ORIGINAL METHOD OF SUBMUCOUS OPERATION ON THE SEPTUM.*

By L. KLEMPNER, M. D., F. A. C. S.,

SEATTLE.

Permanent perforation is a dreaded complication in submucous resection of the septum, especially as it generally occurs at the point of first incision, close to the entrance of the nose. Hamilton¹ counts 22 per cent perforations in 50 cases, which were examined a few years after the operation; five experienced no inconvenience from it, five complained of crust formation and bleeding, and one of a whistling sound. Capt. Stivers,² in a series of 133 cases, had only twelve perforations, about 9 per cent, but in immediately applying sutures he was able to cure all but one.

In examining patients in our everyday work we find frequently perforations—and some are suffering from them, too. I saw a patient last month with erysipelas of the face, which had started from an ulcerated margin of a septum perforation. I have seen two physicians, operated on by well known men, with large septum perforations—and personally I believe a large perforation is better than a small one, when I remember a patient with a small hole which created a nice whistling sound in the nose with every deep breath.

Some men are going so far as to look at a perforation as something immaterial (Katz, Fein),³ as long as the deviation is well corrected. Most operators are in dread of them. Fear of them induced Freer to make out of a simple operation a very complicated proceeding with a big set of instruments. I have seen men losing much precious time trying to go through the cartilage and elevate the mucous membrane on the opposite side, always in fear of a perforation.

*Read before the Pacific Coast Oto-Ophthalmological Society, August 6, 1919.

It is easier to save the mucous membrane on the concave side, as it is more relaxed, thicker, and not so adherent. But as we usually operate from the convex side, it is a difficult task just the same. All such perforations become somewhat larger afterwards through scarry retraction, but you still find Sribny⁵ recommending to cut straight through the whole septum, then elevate the mucous membrane from each side. He claims to seldom have perforations. All of us probably imitate him once in a while, but against our own will.

After reading the caution in every description of a submucous resection to use care when perforating the cartilage on account of the danger of the perforation of the mucous membrane on the opposite side, I believe it must be quite a relief to learn that you can perforate cartilage and elevate the mucous membrane without any fear of perforating the latter.

I am describing a simple operation for deflected septum, where these mentioned complications can be avoided.

The operation is based on the fact that there will be no permanent perforation of the septum, even if we make incisions on both sides, as long as they are not opposite each other. We need not be afraid to make a second incision on the other side. The mucous membrane on both sides must be elevated anyway, so a smooth second incision will not delay healing, and just after a short time the place where it was made can hardly be recognized. Quite frequently extra incisions in the mucous membrane are made to help drainage and to prevent hematomata.

To describe the operation, I will use my last case, a twenty-year old marine, who suffered from a purulent inflammation of the right frontal sinus, right anterior and posterior ethmoid cells, and an extensive deflection of the septum to the right, opposite the middle turbinate. I made a submucous resection as follows:

I had the patient sit on the operating chair, cleaned the outside of nose and upper lip with alcohol; asked the patient to keep his chin close to the chest during the anesthesia so that the anesthetic would not drip down in the throat. I anesthetized both sides of the septum with cocain powder, moistened with adrenalin solution, gently rubbing it into the mucous membrane until all sensitiveness was gone. I impressed on

the patient the fact that the anesthetic was the most disagreeable part on account of pain and tickling, but that the operation of itself would be absolutely painless. At the end of the cocaineizing the patient had a fainting spell, and I allowed him to lay down for 10 minutes, flat on his back with lowered head.

I made a vertical incision on the left side of the septum quite close to the entrance of the nose, about $\frac{1}{3}$ of an inch from it, with a sharp knife through the mucoperichondrium, and scraped it off with a sharp elevator for a little distance till the white glistening cartilage was distinctly visible, and the elevator penetrated easily between mucoperichondrium and cartilage. I now changed the sharp for a blunt elevator and directed it parallel with the ridge of the nose backwards and upwards without using any force, then backwards and downwards with the whole length of the shank of the elevator, just as Ballenger² describes it so nicely in his book, detaching the mucous membrane over the whole deflected part and some beyond it down to the floor of the nose. It was easily done, as is ordinarily the case with the concave side.

Now I transgressed from the beaten path, turned to the right nostril, where the deflection was bulging, and made a vertical incision in front of the deflection about $\frac{1}{2}$ inch backward from the first incision on the opposite side, lifted the mucous membrane first with a sharp elevator so that the white glistening cartilage was visible, then with a blunt elevator detached the mucous membrane just the same as I had done on the left side. I then perforated the cartilage from this incision with my knife without having to be careful, as the mucous membrane of the other side was already detached, introduced a medium size Killian speculum, which we use for rhinoscopia media, between both mucous membranes so that the cartilage and bone were between both blades of the speculum, and removed the deflected part of the cartilage with Ballenger's swivel knife and Grünwald's alligator forceps, deflected bony part and crest opposite the middle turbinate with Killian's septal forceps, and the thick crest of the maxillary with chisel and hammer. I then made an extra horizontal incision in the posterior inferior part of the elevated mucous membrane, introduced Bernays' splint, covered with tinfoil on the side toward the septum, and sent the patient home.

The instruments I prepare are:

Nasal speculum, probe, 6 applicators, knife, Killian's sharp and blunt elevators, Ballenger's swivel knife, Killian's septal forceps, Grünwald's alligator forceps, chisel and hammer.

The advantages of incisions on both side are apparent. The most important is the absence of danger of perforation of the mucous membrane of the opposite side when cutting through the cartilage. The cartilage is already freed of the mucous membrane and therefore no special care is needed. Both mucous membranes are easier detached, the operation for each is done on the same side. The operation is therefore more quickly performed.

In case there is a subluxation of the anterior end of the triangular cartilage, I made the first incision as done by Hajek, on the edge of the cartilage, free both sides of the subluxated cartilage from mucous membrane, and remove the subluxated part of the cartilage. But even in such cases I generally make an incision on the opposite side farther back, as it is much more convenient and safer to operate from the same side, and the danger of laceration of mucous membrane is considerably diminished.

A few more details to be observed in submucous resection: It is very important to anesthetize thoroughly, even if it takes more time, for the patient is quiet and comfortable during the operation. An annoying element and cause for much delay are fainting spells in some patients. They generally occur during the anesthesia and first part of the operation, seldom afterward. I let the patient lie down flat with lowered head for five to ten minutes, and sometimes have to repeat it several times.

If the first incision must be made very close to the entrance of the nose, or on the edge of the subluxated cartilage, it is advisable to infiltrate with 1 per cent procain, otherwise the first incision may be painful and bleeding may annoy you. The mucocutaneous membrane is thick and tough, tightly adhering to the cartilage and quite difficult to detach. A sharp knife and sharp elevator should be used until the white glistening cartilage is seen and the elevator penetrates easily; then this is changed for the blunt elevator. As the membrane is quite thick there is little danger of laceration.

No deviated portion should be left. I refer especially to two places: One where cartilage, vertical plate of ethmoid and vomer meet; and the crest of the maxillary close to the entrance and floor of the nose. The first is easily removed with Killian's forceps, the second with chisel and hammer. It is remarkable how difficult it is to get the crest with biting forceps, and how easily a few tapplings with hammer on chisel will loosen the whole piece. Let patient blow nose and see if both membranes are attached to each other in the middle line and if there is no bulging. Otherwise go in again between both membranes and remove bulging parts of frame with biting forceps.

According to the advice of Killian, I often make a horizontal incision in the posterior inferior part of the elevated mucous membrane at the end of the operation for drainage. I had a case, with two elderly men, where hematoma developed between the mucous membrane and which took two weeks to absorb. The reopening of incision and removal of coagulum did not help much, as new blood accumulated. I never had an abscess and do not wash the nose with any solution before the operation. I advise covering Bernays' splints on the septal side with tinfoil. It does not stick to the incised wound or laceration and is easily removed the next day without pain and with slight or no bleeding.

I allow the patient to go home immediately after the operation, as he feels quite cheerful and is not bleeding. But I caution him that in a few hours he will feel worse and the nose will start to bleed. He will not have any pain in the nose but may have a headache and probably a bad night as he will not be able to breath through his nose at all. Against severe headache I advise taking 10 grains of acetylsalicylic acid. In that way the patient knows what to expect and does not call the physician immediately to his house as if he is bleeding to death.

The mucous membrane of the concave side should always be easy to elevate without laceration, but the convex side is more difficult, as the mucous membrane is here stretched, thinner, and is more adherent to the crests. If there are no lacerations there is nothing to do after the splint is removed

the next day; but if there are any lacerations, crusts will form and the healing will be somewhat delayed.

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SOME OBSERVATIONS ON DISEASES OF THE
FRONTAL SINUS.

By T. W. MOORE, M. D.,
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I believe that we are not radical enough in our treatment of diseases of the frontal sinus, especially those cases that do not yield readily to the intranasal operation, or those that do, and have a recurrence year after year, or more frequently. These patients should be submitted to a more thorough operation. While many operators are able to do satisfactory intranasal work, is it not better to make a window in one sinus through which you may see each step as taken and know that the entire intranasal floor is removed?

The routine I have followed for several years is as follows:

Having done the preliminary nasal operation, which I usually do after Mosher's technic and having waited for one week or ten days, according to the severity of the symptoms, I proceed to remove the intranasal floor of the frontal sinuses as follows: The skin is painted with tincture of iodine and washed off with dilute alcohol immediately. This prevents such extensive exfoliation of the external layer of the skin as sometimes follows the application of iodine when not removed. A curved incision is then made through the eyebrow extending over the nasofrontal angle upon the nose, beginning just inside the supraorbital notch, extending about one inch. I am seldom able to go through the periosteum with the first incision although this is a desideratum. This incision is followed by profuse bleeding which must be taken care of. The periosteum is then carefully retracted, as it must be preserved. An opening is now made into the sinus with a large Alexander's mastoid gouge, which is enlarged with a rongeur until about three-fourths of an inch long and about one-half inch in width and being of an oval shape. After removing any polpi or pus that may be present, remembering

to protect the mucous membrane as much as its condition will permit, the sinus is explored and the ostium located. I now insert one of these rasps into the nose from the sinus and with it break down the tissues anterior to the ostium, then with the rasps and burrs the intranasal floor of the sinus is removed until the partition between the sinuses is reached. This is broken down with a curette and then if it is feasible the same technic is followed as in the other sinus, only we must work through the opening from the sinus upon the opposite side until there is sufficient space to use the rasps, burrs, etc., through the nose. After the entire intranasal floor, of the now single sinus, have been removed and the upper contiguous portion of the nasal septum removed, the external skin wound is carefully approximated and sutured, an external dressing of a few gauze sponges is placed over the wound and a bandage applied for twenty-four hours when a cocoon dressing with collodion, is substituted and left for eight days. No after treatment is required, excepting an intranasal douche of normal salt solution to remove the secretion from the nostrils. This spares the patient the discomfort of after treatment and is one of the many good features of this operation. The introduction of a probe into the frontal sinus often gives a patient relief from pain for a varying period, but I have yet to see a case where any benefit was derived from washing out the frontal sinuses, more than the relief given by the introduction of a probe, in fact I regard the introduction of fluids into the frontas sinuses as harmful.

It will be observed that this is the Lothrop Operation with such changes in technic and instruments as an individual operator makes.

DIGEST OF AMERICAN OTOLOGIC LITERATURE
FOR THE YEAR 1919.

BY OTTO M. ROTT, M. D.,

SPOKANE, WASH.

I.—HEARING TESTS.

1. Callahan, John F.—Laws of the Hearing Centers and the Application of These Laws. *Laryngoscope*, St. Louis, 1919, XXIX, 522.
2. Callahan, John F.—Consensual Reaction of the Hearing Centers. *Laryngoscope*, St. Louis, 1919, XXIX, 569.
3. Dean, L. W. and Bunch, C. C.—The Use of the Pitch Range Audiometer in Otology. *Laryngoscope*, St. Louis, 1919, XXIX, 453.
4. Kernan, J. D., Jr.—Bone Conduction of Sound in Cetacea and Its Relation to Increased Bone Conduction in Human Beings. *Laryngoscope*, St. Louis, 1919, XXIX, 510.
5. Stein, O. J.—Three Reflex Signs Useful in Examining the Ears for Deafness. *Laryngoscope*, St. Louis, 1919, XXIX, 659.

Callahan in discussing laws of the hearing centers and their application, states his law as the proper explanation of the fact that a vibrating tuning fork placed upon the skull is much more distinctly heard in that ear the external meatus of which is closed. This is the author's law:

"When two sounds which have similar properties except intensity are transmitted one to each ear, both impulses will pass to the hearing center on that side where the intensity is the greater; and there will be a summation of the two stimuli. We are, therefore, conscious of the hearing of the sound louder than if the sound of lesser intensity did not reach the ear, and also if both sounds reach each ear with equal degrees of intensity. The increase due to the summation is not equal to an arithmetical addition but follows Weber's law."

The author has noticed that the placing of a closed funnel or otherwise excluding outside noises from one ear has the same effect as directly obstructing the canal with the finger. The lateralization is explained as follows: "By cutting off extraneous sounds on one side we are able to hear the sound of a fork placed on the skull louder in that ear, and this difference is sufficient to cause a lateralization of the sound of lesser intensity that reaches the cochlea of the unobstructed ear, together with the sound of greater intensity in the obstructed ear in the hearing center on the side that receive the sound of greater intensity. There is a summation of the two sounds which is another factor in increasing the intensity."

The author then goes on to describe tests to prove his theory that the increase and lateralization of the sound in the obstructed ear is due to the shutting off of extraneous sounds, and that there is no such thing as increased bone conduction.

The reason offered for the fact that when the sound is lateralized it is not heard in the nonobstructed ear is that when the vibrations reach the cochlea on the nonobstructed side they pass from thence to the hearing center on the obstructed side via nerve tracts. This produces the summation which is a factor in the increased sound.

The two factors then in the lateralization and increase of sound in obstructive deafness are (1) Cutting off extraneous sounds and (2) the summation in that hearing center.

The author shows how to demonstrate the summation of stimuli with forks and tubes, and adds a description of the test with the dictaphone which shows how the two hearing centers act at the same time.

Callahan presents a second communication on the lateralization and summation of sounds which he calls consensual reaction in the hearing centers.

The consensual reaction of the hearing centers in the lateralization and summation of two sounds, one of which goes to each ear and which vary only in their intensity, places one more test in the hands of the psychologist and neurologist in testing the mode of action or reaction of specialized nerve centers and aids in localizing intracranial lesions.

Callahan says the neurologist in testing consensual reaction of the pupils can now pass to the ear, where we can give a similar demonstration in testing impulses that pass from one side of the brain to the other side by well recognized tracts. Any individual who cannot lateralize as per the law of the hearing centers has surely some process along the route taken by the auditory fibres that rise from the accessory nucleus in the pons, as most of the fibres arising in this nucleus pass to the other side.

Theoretically it would be possible for an individual to lateralize the less intense sound that reached the right ear, where he would be unable to lateralize if the less intense of two sounds reached the left ear. The lesion in such a case would be along the crossed fibres of the left auditory nerve.

When an individual is unable to lateralize as in Weber's test, we should at once question ourselves as to the possibility of a block somewhere in the cross fibres that connect the auditory nerve on one side with the hearing center on the other side.

The *modus operandi* of the consensual reaction is given by Callahan as follows:

"When a vibrating tuning fork is in contact with the forehead or teeth in an individual with two normal ears, he is conscious of hearing the fork in both ears, or as is most likely the case, he will tell you that he hears it in the center of his head. Obstruct the external auditory canal on one side and the sound of the fork is lateralized to that side. That the vibrations from the tuning fork reached both cochlae with equal degrees of intensity we will admit; but when we obstruct the external auditory canal on one side, the fork is heard with greater intensity on that side, due to excluding extraneous sounds. Then we get a lateralization of the sounds and a consequent summation in the hearing center that is on the side of that cochlea that appreciates this sound of greater intensity.

The vibrations pass to both cochlea, but the impulse does not pass to the hearing center on that side, but crosses over to the hearing center on the opposite side and is superposed on the impulse that reaches the hearing center from the cochlea on that side."

Dean and Bunch have devised an instrument to test the tonal ranges of hearing which they have called the pitch range audiometer which measures the tonal range from 30 double vibrations to 10,000 double vibrations. The authors claim three distinct practical advantages for their instrument:

1. It measures the practical tonal range in much less time than can be done with the tuning forks.
2. It tests every note in the range measured while the forks test only a very few.
3. In 25% of these cases defects unsuspected after an examination with the Bezdol forks, covering over an hour, have been detected in two or three minutes with their instrument.

In testing the hearing of one ear it is always necessary to use a noise apparatus. The authors claim that the results obtained by their machine may be compared to perimetry of the eye. The results are shown graphically by means of curves, certain curves being suggestive of certain lesions. The steps regulating intensity and pitch are controlled at will. The essential parts of the instrument are a telephone magnet and a toothed wheel, the latter driven by a motor. Each prong of the magnet fits snugly in front of one tooth of the wheel and a low tone is produced by having the motor run very slowly. The intensity is regulated by using the resistance in the telephone circuit as a shunt, that is, a bridge across the receiver circuit. The method of marking the graphic chart is to have the intensity steps for the vertical scale (1 at the top and 7 at the bottom) and the frequencies or pitch recorded at the bottom as a horizontal scale (200 to the left end and 3,200 to the right).

After recording the tones heard at a given intensity, the resistance is set at the next fainter step and the procedure repeated. The authors offer the following summary of the accomplishments of the pitch range audiometer:

1. It produces each and every tone within the significant range of tonal hearing without any gap whatsoever.
2. It produces a relatively pure tone, pure enough for all practical purposes.
3. It furnishes a convenient method of varying the intensity from below the threshold up to a sound that is on the verge of being painful for any pitch.
4. Both the pitch and the intensity of the tone can be measured and recorded instantly and with precision at the time of hearing.
5. The examiner can sweep through the entire pitch range at one stroke for any steps controlling intensity and to sweep through at a single stroke all the intensities for a given pitch.
6. The operation of the instrument is so simple and quick that a complete measurement can be made in a very small fraction of the time employed in making the ordinary tests now in vogue with otologists.

Kernan has made a study of the anatomic arrangement of the ears of whales in order to explain the phenomenon of

increased bone conduction in human beings. After showing that whales do hear water-borne and not air-borne sounds, the author goes into a detailed description of the anatomic characteristics of ears of cetaceans. From the anatomic structures thus detailed the author presents his conclusions as to the hearing in cetaceans, and he decides that in cetacea there are all the elements normally present which have been advanced to explain the symptom of increased bone conduction in the diseased ear of human beings and the anatomic arrangements there found could certainly support the explanation of the phenomena advanced. The author's own words in concluding his report are:

"What conclusions then can we draw from the anatomic structure as to hearing in cetaceans? We have presented to us an auditory apparatus, typically mammalian, designed to receive air-borne sounds modified to one designed to receive water-borne sounds. The external meatus has been practically closed, the drum membrane fixed and the ossicles rendered immovable through fusion of the malleus to the os tympanicum. Sounds are evidently transmitted to the cochlea through the solid tissues of the head. The possibility of this is increased because in both forms the auditory bones themselves present on the surface of the skull a considerable bony process. In both, moreover, the periotic and tympanic are but loosely connected to the other bones of the skull. Thus they can receive only such sound waves as impinge directly on themselves. Since the malleus is firmly fused to the tympanic it would share the vibrations of that bone, transmitting them through the other ossicles to the oval window. This is probably the explanation of hearing in cetacea, that sound waves impinging either on the tympanomastoid in odontocetes, or the true mastoid in mystacocetes, are transmitted through the chain of ossicles to the cochlea, the endolymph being put into motion through the foot plate of the stapes as in other mammals.

"We may now consider the light which the mode of hearing in cetacea throws on the clinical symptom of increased bone conduction in deafness due to disease of the middle ear. It will be seen at once that any change which would connect the ossicles more firmly to the tympanic ring, approaching the complete fusion found in whales, would increase bone conduction. A tense, thickened, rigid drum membrane would do this. We could also accept Bezold's idea that it is a thick, tense ligamentum annulare, transmitting vibrations to the foot-plate of the stapes, which in some cases explains the phenomenon under discussion. This would be the condition following a radical mastoid operation. Another theory may now be mentioned. When the external canal is lightly blocked bone conduction is increased. This is explained by conceiving the air filled cavity with bony walls to be a sounding box. This is just what we have present in cetacea. In this connection it may be said that the variation in the size and number of the cells present in the human mastoid process may very well be an explanation of the variation in the response to tests of bone conduction found in seemingly similar cases of deafness."

Stein described three reflex signs useful in examining ears for deafness, especially in patients in whom the subjective element is

valueless as in feeble-minded patients and malingerers. If any reflex sign is elicited it is evidence in favor of some remnant of hearing left in the ear under examination.

The three reflexes are:

- (1) The auricular.
- (2) The pupillary.
- (3) The cochleopalpebral.

A positive auricular reflex consists in a slight movement of the auricle upward or forward. A positive pupillary reflex consists in a contraction of pupil. A positive cochleopalpebral reflex consists in a movement of the upper lid.

All reflexes are unilateral in action.

II.—VESTIBULAR TESTS.

6. Carpenter, E. R.—Central Deafness. *Laryngoscope*, St. Louis, 1919, XXIX, 25.

7. Cohen, S.—Essentials of Barany Tests. N. York. M. J., 1919, CIX, 324.

8. Dixon, W. E.—Static Labyrinth. *Northwest Med.*, Seattle, 1919, XVIII, 47.

9. Fisher, L. F.—Practical Value of Ear Studies. *Laryngoscope*, St. Louis, 1919, XXIX, 374.

10. Fisher, Lewis and Babcock, H. L.—The Reliability of the Nystagmus Test. *J. Am. Ass.*, Chicago, 1919, LXXII, 779.

11. Hayden, A. A.—Vestibular Rotation Reactions and Routine Otolaryngologic Examination of 3,748 Applicants for the Aviation Section of the Signal Corps of the U. S. Army. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919, XXVIII, 518.

12. Horn, Henry.—The Role of the Labyrinth in Flying Efficiency. A Study of 768 Cases at the Third Aviation Instruction Center, Issoudun, France, American Expeditionary Force, from Sept., 1918, to Jan., 1919, *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919, XXVIII, 381.

13. Levy, Louis.—Vestibular Reactions in 541 Aviators. *J. Am. M. Ass.*, Chicago, 1919, LXXII, 716.

14. Lewis, E. R.—Studies of the Ear as a Motion-Sensing Organ. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919, XXVIII, 10.

15. Lewis, E. R. and Horn, H.—Medical Studies on "Feel of the Airship," Deafmutes and Normals. *Laryngoscope*, St. Louis, 1919, XXIX, 65.

16. Maxwell, S. S.—Labyrinth and Equilibrium.

I. Comparison of Effect of Removal of Otolith Organs and of Semicircular Canals. *J. Gen. Physiol.*, 1919, II, 123.

17. Sachs, Ernest.—The Importance of More Intimate Co-operation Between the Various Specialists Who See Neurosurgical Cases. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919, XXVIII, 76.

18. Willcutt, G. H.—Vestibular Reactions in Central Nervous Diseases. Report of 3 Cases. *Laryngoscope*, St. Louis, 1919, XXIX, 145.

19. Wood, Ernest.—The Ear as an Aid in Diagnosis. *Northwest Med.*, Seattle, 1919, XVIII, 157.

Carpenter reports a case of central deafness in which the vestibular tests showed that there was an apparently hopeless lesion involving both auditory tracts in the upper pons. Subsequent developments where complete recovery from symptoms due to intracranial pressure, especially in region of pons, followed a sudden discharge of pus and blood from the left ear, gave rise to the supposition that the lesion was a left-sided basilar abscess, possibly a temporosphenoidal lobe abscess, pressing against the root of the left fifth nerve with contralateral pressure of the right upper pons against the inner part of the posterior aspect of the petrous bone and attached tentorium.

In the etiology of this condition two factors can be mentioned: (a) typhoid fever at fifteen years of age and the numerous attacks of pneumonia between the ages of eleven and sixteen; (b) the occurrence of the abscess in the left ear two and on-half years ago.

Conclusions offered from a study of this case are:

1. The lesion in nerve deafness should always be located.
2. The vestibular reactions are of great value in the localization of intracranial lesions.
3. Vestibular disturbance should always be considered in the etiology of obscure gastrointestinal disease.
4. More frequent recourse to well-established surgical procedures will still further limit the number of hopeless intracranial diagnoses.

Cohen discusses the essentials of the Barany tests, and some indications for employment.

Among the conditions which call for the tests the following are mentioned:

1. Cases of vertigo.
2. Cases of spontaneous nystagmus, especially if vertical.
3. Cases of meningitis or brain conditions proper.
4. In palsy cases, especially in some of the cranial nerve palsies.
5. In cases of convulsions.
6. In cases of ataxia.
7. Blindness, especially when caused by central lesion.
8. Deaf mutes.
9. Malingerers.
10. Some cases of mental aberration.

While the tests are extremely simple and may be learned and easily executed in a short time, the difficulty is in analyzing the results.

After stating the results to be expected in a normal case, the author mentions the following propositions which are an aid to the making of a proper analysis of the results of a pathologic case:

1. If stimulation of the right ear is negative for nystagmus, vertigo, past-pointing and falling, and in addition there is as corroborative evidence total deafness of the right ear; it shows a destruction of the right labyrinth or eighth nerve on the right side.
2. If stimulation of the right horizontal canal is negative for nystagmus, vertigo, past-pointing and falling are present, the lesion is probably in the medulla between Deliter's nucleus and the posterior longitudinal bundle.

3. If stimulation of the right horizontal canal shows nystagmus and an absence of vertigo, past-pointing and falling, the lesion is probably in the right inferior cerebellar peduncle.

4. If stimulation of the right ventricles is negative for nystagmus, but vertigo, past-pointing and falling are present, the lesion is in the posterior part of the pons near the posterior longitudinal bundle.

5. If stimulation of the right verticals gives nystagmus and is negative for vertigo, past-pointing and falling, the lesion is in the right middle cerebellar peduncle.

6. If stimulation of the horizontal and vertical canals of both ears does not show nystagmus, but does give rise to vertigo, past-pointing and falling, the lesion is in the posterior longitudinal bundle.

7. If stimulation of the right horizontal and right vertical canals shows nystagmus, and an absence of vertigo, past-pointing and falling, the lesion is in the cerebellar nuclei.

8. If stimulation of all canals gives nystagmus but an absence of vertigo, past-pointing and falling, the lesion is at the point of decussation of the superior cerebellar peduncles.

9. If the right ear is totally deaf and stimulation of the right horizontal and right verticals gives no nystagmus, vertigo, past-pointing or falling, and in addition the left verticals show impairment or even an absence of function, the growth is located in the right cerebellopontine angle.

As an aid in the differentiation of a central from an end-organ lesion the following table is offered:

CENTRAL.	END ORGAN.
1. Spontaneous vertical nystagmus.	1. None.
2. No tinnitus, but if present, tends to get worse.	2. Present and improves.
3. Normal hearing tests with impaired or nonresponsive canals.	3. Hearing tests not normal; canals normal.
4. Disproportionate impairment of responses after ear stimulation.	4. Proportionate impairment of responses.
5. Perverted or inverse nystagmus after stimulation.	5. Nystagmus, if present, is usually normal in character.
6. Conjugate deviations following stimulation.	6. Not present.
7. Romberg present.	7. Rarely present.
8. Cranial nerve palsies very often present.	8. Rarely present.

Dixon refers to the work of Jones and Fisher and emphasizes the importance of the vestibular tests, not only to the otologist but also to the ophthalmologist, the neurologist, the syphilologist, the surgeon and the general practitioner.

Fisher discusses in simple terms the importance of the vestibular tests and explains how the phenomena are produced when the tests are made.

Fisher and Babcock have made a study of the reliability of the nystagmus test as a measure of the function of the vestibular mechanism, because this reliability had recently come to be questioned by some prominent psychologists. Fliers of 2,000 hours' flying experience were tested and in no instance was there a reduction in the nystagmus time. The conclusions offered are:

1. The duration of after-turning nystagmus is not impaired by flying. Such a very large number of aviators have been examined as to make this conclusion absolute and final.

2. From the evidence at hand, it would seem that in acrobats, whirling dancers, alldrome performers, and in athletes in general, there is no diminution of the nystagmus response. More examinations of such persons, however, would be necessary before any final conclusion should be drawn.

3. Repeated turning experiments on normal persons occasionally produce an "apparent" and slight shortening of the nystagmus, but that this is only apparent and not real is demonstrated by the convex glasses.

4. In medical practice, an absence or impairment of eye responses following ear stimulation definitely indicates a pathologic condition within the vestibular mechanism.

Hayden gives the following totals and averages of the vestibular rotation reactions of 3,748 applicants for the aviation service:

1. Nystagmus.—After turning to the right, 3,748 cases showed an aggregate of 82,231 seconds of nystagmus, representing an average of 21.9 seconds each.

After turning to the left, the aggregate was slightly larger, being 82,373 seconds, or an average of 21.9 seconds each.

2. Past Pointings.—After rotation to the right, the right arm past-pointed 7,201 times, giving an average of 1.89. The left arm past-pointed 6,663 times, with an average of 1.77.

After rotation to the left, the right arm past-pointed 8,029 times, making an average of 2.14. The left arm past-pointed 7,083 times, with an average of 1.88.

3. Of the 3,748 applicants, only 142 were rejected for abnormalities of the kinetic static sense. Of these 110 failed in past-pointing, 17 in nystagmus, and 7 in falling. Twenty-two men were nauseated and 31 more vomited.

4. Of the total number examined, 692 were rejected as being unfit to become flyers, while 3,056 were pronounced about 100% physically perfect by the examining unit. The disqualification percentage for all causes was 18.4 or 692 out of 3,748. In addition to the 142 enumerated above, 302 of these failed in the eye examination, 91 in the ear, nose and throat, and 157 in the general physical tests.

Horn writes on the role of the labyrinth in flying efficiency, basing his observations on a study of 768 cases at the third aviation instruction center, Issoudun, France, American Expeditionary Force, from September, 1918, to January, 1919.

The conclusions offered are:

1. The slight differences noted strengthen the belief that as a result of continuous air work—acrobatic work—monitor work or work over the lines the labyrinth reactions are not changed in any essential particular.

2. Among the select and the successful the hypersensitive to motion type are few and far between.

3. Many typical hypersensitive to motion types can accommodate themselves to this handicap and become successful.

4. A very considerable number of those who slipped through the entrance examinations or who were on the border line of the hypersensitive to motion type were not able to overcome the handicap and are dropped by the roadside.

5. Given an intact and well-balanced labyrinth—there is nothing to indicate that the lower nystagmus limit is of consequence even as far down as 13 seconds.

6. The normal labyrinth findings, as previously determined, are substantiated by our studies.

7. Special care should be exercised in allowing candidates with a hypersensitive to motion history and nystagmus around 30-35 seconds to enter the service. Thirty-five seconds is the extreme margin of safety.

8. With the great amount of material which America has to select from, no one should allow themselves to be influenced by the exceptions brought out in this paper.

9. Although almost any handicap of hypersensitiveness to motion can exceptionally be overcome, why should we risk the possible serious consequences?

Levy examined 541 aviators to determine whether repeated stimulation had a tendency to lessen the reactions to turning, and he has given the following summary of his work:

1. It is found that nystagmus is not diminished by repeated turnings.

2. Although vertigo was not timed, past-pointing and falling were slightly diminished in fliers of 100 hours' or more experience, being most noticeable in fliers who have had the greatest number of hours.

3. As past-pointing and falling are objective signs of vertigo, this diminution was due to the fact that the flier had learned to interpret this vertigo and for the same reason more rapidly recovered his poise.

Lewis offers the following resume of the studies of the aviation medical service concerning the ear as a motion-sensing organ.

1. Of the senses concerned in motion-sensing (such as vision, deep-sensibility, tactile and vestibular sense), the vestibular sense is the only one whose utility remains constant (either on the ground or in the air); hence the necessity of determining the aviator's possession of requisite vestibular sense.

2. Vestibular tests not only determine the functional condition of this portion of the internal ear, but give definite information concerning the integrity of parts of the medulla oblongata pons, cerebrum and particularly the cerebellum.

3. Observations made in an extensive series of blindfold experiments on normal persons, on persons with non-functioning vestibular apparatus, on persons lacking hearing only, and on persons with impaired deep sensibilities indicate that perception of motion in a linear direction.

(a) During acceleration, is sensed most accurately by those whose vestibular apparatus is functioning;

(b) At a sustained rate of speed is sensed accurately by each group except those lacking deep sensibility;

(c) During retardation is sensed accurately by those whose vestibular apparatus is functioning;

(d) Arrest of motion ensuing upon motion in a linear direction is most accurately detected by the group lacking vestibular function but in possession of unimpaired deep sensibilities.

4. Special ability to estimate correctly the degree of falsity of oft-repeated motion sensing illusions may be developed in normal persons through experience and education. This special ability enables its possessor to maintain safe bodily relation with his environment during the existence of the motion sensing illusions with which he has become familiar through long experience.

5. A superficial observation might suggest that possibly the safest aviators would be those lacking vestibular function, such as deaf mutes, inasmuch as they are incapable of developing motion sensing illusions which, in normal persons, ensue upon spinning nose dives or other whirling aeroplane maneuvers. Possession of normal functioning sensory end organs always entails the possibilities of subjective sensory illusions, but to argue the advantage of lacking such special sense end organs is, naturally, to reach the reduction ad absurdum.

Lewis and Horn have made some studies on motion sensing or "the feel of the airship" on deaf-mutes and normals. In this study it has been demonstrated that men with normal inner ears when blindfolded were able to detect motion changes during flight, whereas blindfolded deaf-mutes with destroyed labyrinths were not.

The authors have demonstrated by their series of experiments—the results of which are detailed—that man's ability to sense motion is measured by the full possession of visual acuity, deep sensibility (muscle sense), vestibular sense acuity and tactile sense. And particularly, that the "feel of the airship" which is the sense complex that makes for a first-class pilot, requires normal vestibular motion sensing.

Experience in aeroplane flights shows that blindfolded normal persons perceive motion changes accurately; that blindfolded persons lacking normal vestibular apparatus do not.

One who shows good responses in the turning chair shows good detection of movement in the air. One who shows poor responses in the turning chair shows poor detection of movement in the air.

Maxwell has made some experiments on the comparison of the effect of removal of otolith organs and of semicircular canals from the results of which he is convinced that the assumption of a sharp differentiation of function between the otolith bearing vestibular portions of the labyrinth and the semicircular canals is not justified by the facts. Between the effects of extirpation of the one and of the other set of structures there is more resemblance than contrast. They certainly reinforce each other, for the reactions produced by either one alone are always slower and less vigorous than when both sets of organs are intact. It would not, however, be safe to affirm that the functions are identical. In one respect a difference is apparent, namely, in the response to rotation in a horizontal plane. If the ampullæ are uninjured, compensatory movements

occur when the animal is rotated around its dorsoventral axis. Maxwell has never seen this reaction in the absence of the ampullæ of the horizontal canals.

In discussing the importance of a more intimate co-operation between the various specialists who see neurologic cases, Sachs gives his views on the value of the Barany tests in a localizing diagnosis. Sachs always has these tests made out, as this examination is merely the examination of one-half of one of the twelve cranial nerves, and as some of the pathways of the vestibular fibres have never had any anatomic proof, he uses the results merely as corroborative evidence—that is, if all other findings are negative, he is willing to subject a patient to operation when only the Barany is positive.

Sachs advises that the specialists take a greater interest in the nervous system as a whole, rather than in that portion pertaining only to their specialties.

Willcutt draws attention to the close association existing between the neurologist and otologist, especially in those cases of nervous disease where the prominent symptoms were labyrinthine, hence the patient's reason for first seeking an otologist.

When the aurist recognizes the fact that many labyrinthine phenomena are but the earliest manifestations of disease of the central nervous system, he is able to send the patient for a neurologic study and often by timely diagnosis and treatment render valuable assistance to the patient while still in the curable stage.

Three case reports are added, two of early multiple sclerosis and one of latent syringomyelia.

Wood refers to the aids which a thorough examination of the vestibular branch of the auditory nerve offer to the neurologist, syphilologist, surgeon, ophthalmologist, internist and general practitioner.

III.—DISEASES OF THE EXTERNAL EAR.

20. Rosenkranz, Otto H. G.—Maggots in the Ear. *J. Am. M. Ass.*, Chicago, 1919, LXXIII, 767.

Rosenkranz reports a case of maggots in the ear. Seventy-five maggots were washed out the day after a fly flew into the external auditory canal.

IV.—NON-SUPPURATIVE DISEASES OF THE MIDDLE EAR; OTOSCLEROSIS.

21. Holmgren, G.—Radium Therapy in Tubal Stenosis. *Laryngoscope*, St. Louis, 1919, XXIX, 590.

22. Taylor, J. M.—Hearing and Its Regulation, Especially in Middle Age and Early Senescence. *Med. Rec.*, N. Y., 1919, XCV, 56.

Holmgren reports three cases of tubal stenosis producing exudative catarrh of the middle ear, which were benefited by the application of radium to the pharyngeal orifice of the tube. The benefit occurs because lymphoid tissue is susceptible to the action of radium.

Taylor discusses the subject of voluntary improvement and conservation of hearing, especially in middle age and early senes-

cence, emphasizing the importance of attention and self-regulation of the patient to his function of hearing.

The chief objectives are (1) to achieve conscious control over all parts concerned in hearing, direct and associated, i. e., in training of voluntary and semi-voluntary structures and (2) to direct intelligent attention, critical and helpful, to elaboration, cultivation and refinement of the function of audition, to bring up to par all the latent powers which reside in the aural equipment as a whole.

The following procedures are recommended:

1. Passive motions, manipulations applied to the structures; seize the concha with the encircled fingers, draw it up and down, backward and forward, round and round; in applying manipulation to the neck, the posterior scalp—which is usually found rigid and adherent—also to the dermal structures over the second, third and fourth thoracic vertebrae (vaso-motor subcenters) by pressure and relaxation, by lifting and pulling the overlying skin, and also by mobilizations of the joints of these vertebrae at corresponding levels by alternating pressures.

2. Making active movements of the jaws, opening widely as possible, rotating, side to side, forward and back; also in yawning and swallowing afterwards.

3. Active movements of the neck, to the right, to the left, also thrusting the chin forward each time; then chin up vertically, forward and back.

4. Inducing the patient to seize the back of his head with hands clasped and to bend far forward and down, then to push the hands back with the head (neck muscles) and repeat five or six times with increasing force.

The whole procedures occupy about six or eight minutes and should be repeated at least once, preferably three times daily.

V.—SUPPURATIVE DISEASES OF THE MIDDLE EAR AND MASTOID.

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Alexander reports a case of probable metastatic carcinoma of the middle ear. The patient had her right breast removed three years ago because of a carcinoma and, according to the history, throat and laryngeal symptoms, cough, choking sensation, aphonia and difficulty in swallowing were the first to manifest themselves, hence these parts must have been the first to be involved and extension to the middle ear subsequently. A growth was found in the right side of the pharynx and there was complete immobility of the right vocal cord. The right drum was immovable by compression and aspiration excepting a small area in the anterior and posterior superior quadrants. The lower half of the drum membrane was of a bluish red color as if blood were behind but not against it. There were three small vertical folds in the posterior superior quadrant and fixation of the malleus. Pronounced well-formed blood vessels were seen to extend from the roof of the external canal down over the drum membrane anterior and posterior to the short process of the malleus. There were also many blood vessels extending outward from the drum membrane in all directions, but especially marked on the floor and posterior wall of the external canal. There were no clinical signs of labyrinthine involvement.

Canfield describes the pathologic changes occurring in mastoiditis, acute and chronic, and discusses the clinical significance. He states that pus is probably present in the antrum and neighboring mastoid cells in every case of suppurative otitis media, but this does not mean bone infection. As long as the pus makes its escape freely into the middle ear the disease in the mastoid may be limited to hyperemia, swelling and small-celled infiltration of the antral lining membrane. When, however, the infection is of sufficient virulence or when drainage is interfered with, either by the formation of granulation tissue in the aditus or by the presence of pus in the mastoid cells, escape from which is for anatomic reasons impossible, retention takes place, the bone is attacked and mastoiditis is set up. The cell first affected is the mastoid antrum, the mucoperiosteal lining of which becomes densely infiltrated and suffers a loss of substance. The antrum then becomes filled with infected granulation tissue and pus. This serves as a primary focus from which extension of the disease process takes place as the result of:

1. Direct extension due to pressure of the pus and granulation tissue upon the mucoperiosteum through which course the nutrient vessels of the mastoid cells. The result is destruction of these vessels, necrosis of the walls of the antrum and enlargement of the primary focus.
2. Gravitation of pus into remote parts of the mastoid and formation of secondary foci of disease.
3. Extension by means of vascular channels.

The clinical significance of this knowledge is that it is impossible to determine where necrosis ends and healthy cells begin, so the

safest procedure is to remove all cellular structures wherever found.

Chronic mastoiditis presents four different and distinct processes:

1. Hypertrophy and hyperplasia of the mucoperiosteal lining with conversion into chronic granulation tissue, when the lining loses its epithelial layer. This tissue may persist or may be transformed into (2) bone with complete eburnation or sclerosis.

3. If the hyperplasia of the antral mucosa is sufficient to prevent the escape of pus into the middle ear, necrosis of the mucous membrane follows, exuberant granulation tissue forms, the blood supply of the walls of the antrum is cut off and caries results. Extension of the necrotic process can take place beyond the confines of the mastoid cells into the brain or sinuses. Caries and sclerosis are almost always associated, in which case it generally happens that caries is most marked in the tympanum and in the neighborhood of the antrum, while sclerosis is most marked in the more superficial areas. The result is that the deeper parts are converted into an abscess cavity, the purulent contents of which is in intimate contact with the brain, while the superficial parts form a wall of dense ivory-like bone which renders perforation and escape of pus externally impossible.

4. Cholesteatomatous formation. This consists of an ingrowth of epithellum. This is a curative process if no caries exists and the suppurative process is of a low grade. If, however, the discharge is profuse or if caries exists, proliferation and desquamation are very rapid. The walls of the antrum become lined with this newly-formed membrane of epithellum and when partial obstruction occurs the discharge collects under pressure sufficient to destroy the walls of the antrum and neighboring cells. When associated with caries the pressure of the cholesteatoma is frequently sufficient to destroy the walls of the mastoid and to allow infection to reach the internal ear or brain.

The clinical significance of chronic mastoiditis depends upon the fact that one never can foretell the extent to which the necrotic process has advanced, and inasmuch as 75% of all brain abscesses and the majority of all cases of suppurative mastoiditis are of otitic origin, and as the dura and sinuses can be involved without the causation of symptoms, the presence of a chronic discharging ear cannot be regarded with composure by even the most optimistic.

Clark advises immediate closure of the mastoid wound in mild cases of acute mastoiditis. This advice is based on one successful case in which drainage was procured through the external auditory canal by means of lowering the facial ridge and making a plastic flap as is done in the radical operation. In this case reported the patient left the hospital on the sixth day and was back to work in two and one-half weeks. Drainage was obtained by means of xeroform wool.

Davis offers a modification of the blood clot dressing in mastoidectomy, which consists essentially in rendering the wound cavity aseptic by antiseptics at the time of the operation and iodoform packing preceding the admission of the blood clot. The author's technic is as follows:

All infected and diseased tissue possible consistent with safety is exenterated. In simple mastoidectomy after thorough exenteration of the mastoid and the establishing of free communication from the antrum into the tympanum, a free incision of the membrana tympani is made with a piston syringe, the tympanum is flushed from the mastoid through the canal with 3% iodine solution and then with warm alcohol, followed with warm sterile physiologic sodium chloride solution. Then the mastoid is packed with iodoform gauze and closed to the lower angle save for a space that will permit one end of the gauze to protrude.

In twenty-four hours the packing is withdrawn and the bleeding occasioned by its withdrawal allowed to fill the wound cavity. If enough blood is not forthcoming, a nick or cut with a knife or the scissors is made in the angle or margin of the flap to supply sufficient blood to fill the cavity. The lower angle of the wound is closed with adhesive plaster.

Silkworm gut is used for suture material, and before removal a 3% solution of iodine is applied to prevent possible infection of the clot.

After a radical mastoid the gauze is inserted and removed through the canal, then the meatus is covered with a film of cotton or layer of sterile gauze covered with petrolatum and a bandage.

The advantages of this modified technic are:

1. The opportunity to sterilize the wound with antiseptics at the time of the operation.
2. The completion and maintenance of this sterility by the iodoform gauze packing of the wound for twenty-four hours, which prevents the infection from the deeper tissues that may occur from the operation reaction drainage when the clot is induced at the time of the operation.
3. Its simplicity and effectiveness, which enables the average surgeon to use it successfully in or out of hospitals.

The author reports nine cases in eight of which there was primary healing without deformity, quick convalescence, no painful after-treatment and marked improvement in hearing.

In one case there was healing with slight deformity at the lower angle of the wound where the clot broke down. This was an acute case complicated with large subperiosteal and perisinus abscesses, plus a sinus thrombosis in an alcoholic and syphilitic.

Dickson uses novocain along the auricularis magnus and occipitalis minor and over and around the tip, down the side of the canal and above the zygomatic ridge. After the mastoid is exposed the tip is opened with rongeur forceps. When the cells have been cleaned up to the antrum and this cavity opened, the solution is introduced and left until the field is thoroughly cleansed. The author is very enthusiastic regarding this procedure.

Eagleton discusses reconstruction of the mastoid wound cavity by the use of bone grafts and chips, reporting his experience in two cases. In one the transplantation was done at the time of the mastoid operation, and in the other case the transplantation was performed at a secondary operation following the sterilization of the wound cavity by the Carrel-Dakin method, with better results,

but in both cases the ultimate result was ideal—a smooth, flat surface covering the former mastoid cavity.

The advantages cited for this method of closure are that (2) it does away with the painful dressings; (b) renders less likely secondary infections, and (c) lessens the possibility of a recurrence of the original infection.

The prerequisites to this method of closure are (1) eradication of the infection by a complete operation with a perfect aseptic technic at the time of operation; (2) the filling in of the cavity of the mastoid so that no extensive vacant spaces will remain for the accumulation of blood in which the remaining bacteria and those in the neighboring middle ear may propagate; (3) the erecting of a barrier posterior to the *iter tympani et antri*, in order that, while a cavity is left into which the mucous membrane of the middle ear can proliferate, this cavity be a small one—an antrum—thus imitating nature's process of repair.

Gerber refers to the different types of mastoid structure and the importance of the different types in determining the result or course of an infection, and then goes on to show that these different types can be recognized by means of stereoradiography.

The three types of diploic mastoids are:

Type 1. Persistence of the infantile type in which the mastoid mass is diploic. In this type the thin outer compact layer of the antral wall has increased in thickness from the periosteal side and is of extreme density; the inner layer of "fetal cells" is still seen; the mastoid mass is entirely diploic, and the separating layer between the diploes and the cavity of the antrum is much increased in thickness.

Type 2. Persistence of the infantile type in which the mastoid mass is dense. With exception of the mastoid mass, which is dense, the structures are as described under Type 1.

Type 3. The mixed infantile and pneumatic mastoid, with the infantile characteristics predominating.

The radiogram, especially when a stereoscopic study is made, will practically always show the sinus to be far forward in the infantile types. When to this appearance is added a suggestion of cell structure towards the tip of the mastoid and a cellular area just above and behind the middle ear, the remainder of the mastoid appearing dense, in the writer's experience, Type 1 is to be confidently expected. When the entire mastoid appears dense, with the exception of a small cellular area, often but a faint suggestion, just above and behind the middle ear, Type 2 is to be expected. When to one or the other of the above findings there is added a small group of large cells, though they be but faintly outlined, Type 3 is to be looked for.

The other types of pneumatic mastoids are:

Type 1. The pure pneumatic type, practically all of the cell structures containing air.

Type 2. The mixed pneumatic and infantile mastoid with the pneumatic characteristics predominating.

Type 3. The "double-decked" mastoid. The cells are arranged in two tiers, separated one from the other by a bony septum which

in location and general appearance often closely resembles the internal table.

The author then sums up the practical aids from this radioscopic recognition of variations in mastoid structures.

In the infantile type, by recognition of their presence, a chronic infection of the mastoid can be prevented by early drainage of the antrum, regardless of the absence of the classical mastoid signs. If there is merely a middle-ear suppuration, with definite drooping of the posterior superior canal wall, and an infantile type of mastoid disclosed by the Roentgen-ray examination, the patient should be given the benefit of the doubt by early antral exploration.

With the pneumatic type of mastoid, however, even in the presence of stormy symptoms, operation should not be hastened at the outset. The re-establishment of positive mastoid pressure by means of proper punctures of the drum membrane may be sufficient to produce prompt cure. Of course, if actual destruction of the cell-walls, or the presence of a perisinus or epidural abscess, can be made out, then the indication for operative interference is definite.

Goldstein reports a series of twenty acute mastoidectomies successfully performed under local anesthesia. A 10 c.c. all-metal syringe and all-metal plunger is used with a needle two and one-half inches long and of fair lumen. The most satisfactory anesthetizing solution is one-half of one per cent novocain in distilled water, to which may be added one to ten thousand solution of adrenalin in equal parts.

With a standard hypodermic syringe and needle the subcutaneous injection is made, beginning with the mastoid area in the zygomatic line and working toward the tip. The infiltration includes a belt of about one inch in width and extends from the insertion line of the auricle backwards and parallel to it. The deep injections are then undertaken with the heavier metal syringe and needle, beginning at the same point on the zygomatic line and covering the distance to the mastoid tip at about four points. For the deep injections the larger needle is plunged in a slanting direction downwards until the point engages the mastoid bone. By a slight rotary motion of the hand the needle is worked between the periosteum and the bone and 5 or 6 c. c. of fluid forced into the area. The same technic is carried out at the other three selected points from the zygomatic line to the mastoid tip and in the injection at the tip, the slant of the needle is directed upward toward the head, instead of downward toward the neck. These two injections, deep and superficial, effect an area of anesthesia throughout the field of operation. The classical incision is now made parallel with the insertion line of the auricle and cutting in one sweep from the zygomatic line to the tip, and to the bone.

Before elevating the periosteum forward and backward, and applying retractor, a suitable pledget of cotton, soaked in 10% solution of sterile cocain, is placed in the wound for four or five minutes. The one difficult area to anesthetize during the mastoid operation is the posterior wall of the auditory canal and the middle ear cavity proper. To accomplish this satisfactorily the larger injection needle is passed to the depth of the mastoid incision just

made between the periosteum and the bone and carried to the fundus of the canal as far as possible. Two or three cc. of solution are delivered at this point. If the operation is undertaken simply for mastoid cell exenteration and drainage of the antrum, this one injection into the depth of the canal wall will suffice.

Guttman in discussing the limitations of the diagnostic value of the skiagram states that as a deciding factor in the indication for mastoidectomy it is at the present time of very little value. But it has some points of value. For instance, it may determine the course of the lateral sinus and may aid in differentiating cases of furuncle of the external auditory canal and mastoiditis when the clinical picture points to either one or the other.

Harris offers two important deductions from his experience with acute affections of the middle ear and mastoid following measles:

1. Otologic complications are so unusual in their symptomatology that the only certain means of recognition is the routine examination of the ear itself.

2. Far outweighing all measures addressed to relieving infection of the ear is prophylaxis to prevent such infections from developing, such as improved sanitary procedures and local treatment of the upper respiratory tract by means of gargles of warm saline, Dobell's or 2% solution of dichloramin-T. Finally, the establishment of steam-baths may be of great service.

Harris offers another contribution on acute mastoiditis in which, besides repeating his observations just recorded concerning the ear complications of measles, he offers some remarks concerning the aural complications of influenza:

1. The drum picture. The presence of the characteristic hemorrhage bleb is noted.

2. Not much reliance could be placed on drooping of the posterior superior canal wall as an indication for operative interference.

3. Thickening of the periosteum over the mastoid was a valuable aid in the diagnosis.

4. While great reliance was placed on the roentgenoscopic findings, these are not infallible.

5. The operative findings varied. Little or no changes were noted in mastoids opened early.

6. There was no uniformity in the nature of the organism recovered.

7. There were marked slowness in the time of healing.

Harris reports an interesting case of severe and uncontrollable hemorrhage following mastoidectomy in a patient suffering from purpura. During the little more than two weeks following the operation there was constant oozing, but the bleeding was finally controlled. During this period 1,400 c. c. of human blood was transfused. Locally coagulen oils and hemoplastin were used, the latter apparently giving the best results, but the bleeding from the mastoid wound was not controlled until the wound was sutured.

In commenting on this case, Harris discussed the difference between hemophilia and purpura. Hemophilia is a hereditary disease characterized by a deficiency in one or more of the clotting properties of the blood which results in prolonged coagulation time. Purpura, representing many different conditions, is characterized

by a deficiency of the blood platelets. Hemophilia is likely to occur in males, although it is transmitted through the female. Purpura occurs both in the male and the female. The bleeding in hemophilia occurs usually after injury; that from purpura is likely to occur spontaneously, and is characterized by frequent subcutaneous hemorrhages. In hemophilia there is a deficiency in the amount of prothrombin; in purpura it is normal.

In the present case the purpura was of the hereditary type, as the patient had two brothers die from hemorrhage. In other respects the features characteristic of purpura were present.

Hays describes a case of acute mastoiditis with no mastoid symptoms in which the diagnosis was made by means of the X-ray. True there had been recently an acute suppurative otitis media and since this the patient complained of an uncomfortable feeling in that ear. The discharge had ceased, there was no temperature nor tenderness on pressure over the mastoid, but the X-ray showed absence of cell outlines in mastoid. Operation revealed mastoid completely filled with pus and no communication between antrum and middle ear.

Hill presents the following conclusions from his study of 120 cases of acute suppurative otitis media following 6,870 cases of influenza occurring at the U. S. A. General Hospital No. 14.

1. Otitis media was an infrequent complication of influenza and occurred more frequently in cases developing pneumonia. There were 1,600 cases of pneumonia and 66 of the cases of otitis media occurred among these. Of the 120 cases, 17 were bilateral and 16 of these occurred among the pneumonia cases.

2. The type of otitis media shows first a hyperemia and then an acute hyperplasia or hyperplastic edema of the mucous membrane of the middle ear.

3. This give a certain definite and characteristic picture including a drooping of the canal wall. This last sign is not indicative of a suppurative mastoiditis.

4. The operative signs indicative of suppurative mastoiditis are: Increased purulent discharge and thickened mastoid periosteum. Mastoid tenderness and edema, if present, together with these signs, are added arguments.

Holmes discusses mastoid cases seen at Camp Sherman, emphasizing the importance of early operation and pointing out certain reasons for poor results, namely:

1. Constant reinfection of the wound from nasopharynx, eustachian tube and tympanic cavity, especially in the presence of a nasal sinusitis, whose activity is influenced by such factors as constipation, overloading of the stomach with food or alcoholics, and undue exposure with the lowering of the inhibitory powers of vascular tone.

2. Overcrowding.

3. Infection by contact.

In conclusion Holmes wisely advises the aural surgeon to look upon every discharging ear as one that may lead to fatal complications, to watch every symptom, and to bend all his energies toward preventing further progress, to adopt the rule that pus must

be sought for the moment its presence is suspected and then promptly to drain and remove the cause.

Kahn has devised a curette and a burr for reaming the upper end of the eustachian tube in the radical mastoid operation. The curette is called a mouse-nosed eustachian curette. The curette end of the instrument consists of quite a long spoon tapering to a point. The sides of the spoon are very sharp and fine-cutting. The spoon is tipped at its apex by a probe-like nose which does not extend out from the spoon but gradually tapers into it. The spoon tapers into a long handle. The beaded nose acts as a feeler, and prevents piercing soft parts.

The burr is tipped and tapering similar to the curette and can enter the tube much deeper.

Kahn describes his method for using Dakin's solution for continuously irrigating the mastoid wound. One long rubber tube projects from the upper angle of the wound and a short tube from the lower angle. The upper tube projects beyond the dressing and is attached to the syphon tube. A miniature Kelly pad, on which the head rests when patient is in bed, carries away the fluid. When patient is in an upright position, a pad, the lower portion of which is shaped like a funnel, is made a part of the dressing and directs the solution into the lower funnel-shaped portion from which it flows out.

Kelly offers the following conclusions from his study of nearly 200 cases of acute otitis media purulenta and some 48 cases of acute mastoiditis at the Base Hospital, Camp Stuart, Va.:

1. It is very difficult to obtain a pure culture or to know the inciting organisms in acute purulent otitis media.
2. Mixed cultures will invariably be present after 24 hours of discharge.
3. The presence in a discharge of virulent pyogenic organisms does not necessarily mean that mastoid involvement will follow.
4. The individual anatomic characteristics of the mastoid may not be a deciding factor in the development of mastoiditis.
5. Acute purulent otitis media should never be syringed with the hope of irrigating the middle ear. Free drainage with or without wicks is the treatment to follow, keeping the canal free from obstruction. A piece of absorbent cotton may be placed in the auricle to absorb the secretion and this covered with a handkerchief or bandage.
6. The X-ray in acute mastoiditis is not to be depended upon for diagnosis.
7. An acute purulent otitis media lasting over three weeks and discharging freely all that time invariably means mastoid involvement and should receive operative treatment in order to preserve hearing and protect against the condition of becoming chronic.
8. A complete exenteration of all possibly affected cells should be done at the time of the operation.

Lawrence offers a rational exposition of the subject of acute suppurative otitis media. He emphasizes particularly the importance of preserving an aseptic condition of the meatus so as to prevent a staphylococcus infection as this nearly always produces

chronicity. The author prefers the dry treatment by means of the cotton wrapped applicator and suction, to the irrigation plan, as there is less likelihood of producing a secondary infection. Lawrence condemns the practice of swabbing the nasopharynx in the acute infectious diseases as this procedure causes gagging and forcing of the infected secretions up the eustachian tube.

Lewy discusses the indications for operative interference and the choice of operation in chronic suppurative otitis media.

Factors to be considered in deciding for or against operative interference are:

1. The economic condition of the patient or his social status, as the latter may be of such a nature that prolonged nonoperative care may be impractical or even impossible.
2. The urgency of the case relative to intracranial or labyrinthine complications.
3. The probability of their developing serious complications.
4. The amount of disability or discomfort caused.
5. The probability of cure by less radical measures.

As to the type of operation, the author mentions ossiculectomy and the modified operation in selected cases, but the radical operation is the most reliable.

Porter gives a brief report of 9 mastoidectomies (one double) performed under local anesthesia. The patient was first given $\frac{1}{4}$ gr. morphin subcutaneously, and in half an hour a 0.5 per cent solution of cocain or procaine was injected into the skin along the line of the proposed incision. The injection was then carried into the deeper layers and finally under the periosteum over the entire area of the mastoid. The insertion of the sterno-mastoid muscle and the posterior canal wall were injected at the last. About 15 cc. of .5 per cent solution were used in each case. After waiting for from 5 to 10 minutes the operation was started.

Potts discusses the postoperative treatment of mastoidectomy by the use of surgical solution of chlorinated soda, and states that this method has the following advantages:

1. It enables the operator to close his wound and still feel that he has as perfect drainage as it is possible to secure.
2. Exposure of the sinus or dura is no contraindication to closing the wound.

3. The ultimate result is a smooth, clean scar without depression.

In a series of 50 cases the average time in which the wound became sterile and the tubes could be removed was 9.35 days. All secretions had ceased and the wound was entirely healed in most of these cases by the fourteenth day and none longer than the eighteenth day. The shortest time in which the tubes were removed was four days and the longest time was eighteen days. The discharge from the external auditory canal ceased in from one to twenty-one days. Potts inserts two tubes; one extending from the time of the mastoid process to the upper angle of the wound and the other from the antrum to the lower angle of the wound. From $\frac{1}{2}$ to 2 inches of the tubing is left out of the bandage and fastened with a strip of adhesive to temporal region of forehead. About one ounce of the solution is allowed to flow through each tube every

two hours for the first two days. After this the irrigation is continued every two hours during the day and every four hours during the night. Dressings are changed daily. As the secretion diminishes, the interval of irrigations is lengthened. When secretion is sterile as determined by culture the tubes are withdrawn. Aseptic precautions are observed in irrigating. In some cases where after four or five days the secretion became profuse, thick and brown, benefit was obtained by flushing wound with boric solution or hydrogen peroxid, removing and sterilizing tube and insert and irrigate for 24 or 48 hours with mercuric chlorid solution 1-5000.

Sautter emphasizes the dangers of an untreated chronic suppurative otitis media, and draws attention to its frequency. In the 357 cases referred to the advisory board by the local boards, 187 were refused active service because of a chronic suppurative otitis media.

The author divides all cases into three groups, as follows:

Group 1. Those cases that are tubal in origin, the infection coming from nose or nasopharynx. Correction of the latter is the best treatment for the aural discharge.

Group 2. Those cases due to some lesion in the cavum tympani, such as a foreign body, granulations, polyp tissue or an exostosis. Local treatment frequently is all that is necessary for cases in this group.

Group 3. Cases in which the discharge comes from the mastoid cells and is inaccessible to local treatment. These require the radical mastoid operation.

Scott, et al., have made a study of acute mastoiditis at Fort Riley, Kansas, from which they have drawn the following conclusions:

The prevalence of mastoiditis in army cantonments is due to a number of reasons. The new surroundings of the recruit play some part in it and constitute a predisposing cause. The presence of a locality infection and epidemics of acute contagious diseases are the chief factors.

2. Invasion of the middle ear and mastoid cells may occur by extension from the nasopharynx or directly from the blood stream.

3. The anatomic structure of the mastoid body is of importance in the prognosis of each case. Radioscopy will alone determine the character of the cell arrangement.

4. For clinical purposes, the mastoid may be classified as Type 1, rudimentary or cell-free mastoids; Type 2, in which the cells are of the pneumatic variety and are found only below a horizontal line drawn through the upper margin of the meatal ring, as shown in the radiogram, and Type 3, showing small cells extending forward in the zygomatic region, high posterior cells, and many delicate cells in the tip. Type 1 mastoids rarely if ever develop acute mastoiditis, but the otitis media is the most marked of all types. In this class of cases, operation reveals the sinus clinging closely to the posterior wall. Type 2 is the most serious of the three and almost always requires operation. The cells of the tip and posterior are of the pneumatic type. The drainage is poor, and necrosis occurs early and may be fulminating in character. Type 3 is characterized clinically by an early tenderness over the entire mastoid area which subsides on the application of hot compresses. They drain easily and seldom

require operation. Mastoiditis is associated with otitis media in only Types 2 and 3. As Type 1 may be due to faulty development or to an otitis media in early childhood, a large number of mastoids of this type are found. This accounts for many severe otitis media cases that show no clinical evidence of mastoiditis, although a high temperature and even chills may occur.

5. Bone necrosis is the one important sign in mastoiditis which must be carefully sought. Its presence makes operation imperative. It occurs in Type 2 with little or no clinical manifestation until the tip and posterior cells become necrotic. Fulminating signs then appear. When operation is indicated, it should be thorough.

6. Chloramin-T paste is a good dressing to use in the after-care of patients.

7. Blood stream invasion may cause the mastoiditis, and with it involvement of structures within the cranium. In such cases meningitis may be hastened by a prolonged operation. So-called otitis meningitis is a very rare complication. Septic joints, pericarditis, meningitis, or abscess of the brain due to the primary invasion may develop, early or late, in the course of the illness. Sinus thrombosis is easily differentiated by the presence of the chill and the rapid rise and fall of temperature.

Sheehan reports a case of acute mastoiditis successfully performed under novocain and morphin anesthetic. Success depends upon proper anesthesia of skin, periosteum, aditus and membrane of the middle ear. The bone has no sensation. Advantages claimed are:

- (1) Injury to the facial nerve is immediately noticed.
- (2) There is practically no after-effect.
- (3) The operation can be performed when general anesthesia is contraindicated.

Simpson reports a case of mastoiditis in which there were few physical signs and symptoms and few abnormal findings in the ear, although the mastoid bone itself revealed extensive pathologic changes. The drum and hearing were normal.

Smith discusses the subject of streptococcus mucosus capsulatus infection in the mastoid and from a study of twenty cases offers the following conclusions:

1. This infection rarely occurs under 20 years of age.
2. A high percentage of the patients have diabetes.
3. The symptoms are very apt to be masked, even in the presence of an extensive destruction in the mastoid process.
4. One of the chief dangers is that of not recognizing the presence of this infection.
5. Practically all of the cases come to operation.
6. Prompt recognition with early and careful surgical intervention will result in a uniformly low mortality.

Smurthwaite emphasizes the physical handicap under which a man labors who is troubled with a chronic discharge from the ear and makes a plea for its prevention by instituting early and efficient treatment of the acute and subacute infections.

Stickney reports two cases of abducens paralysis occurring in acute suppurative otitis media with mastoiditis. In the first case, which cleared up in two weeks following the mastoid operation, the

paralysis was regarded as probably being due to a toxic neuritis, as the dura over the tegmen of the mastoid appeared normal. The author regards the paralysis in the second case as due to a localized basillar pachymeningitis, as the dura in the region of the roof of the mastoid and middle ear was thickened, reddened and adherent and showed an exudate in the region of the tegmen tympani.

As to the treatment aside from the mastoid operation and exposure of the dura, the author advocates KI and fluid extract of jalorandi; of the latter gtts x to xx t. i. d. to aid the iodids. Or pilocarpin hydrochlorate, one-eighth to one-half gr, hypodermatically daily or every other day for the same purpose.

After the diplopia has disappeared strychnin sulphate, gr. 1/100 to 1/40 before meals as a tonic to nerve and muscle.

The interrupted current of electricity, used once daily for ten minutes, may be of service.

Mechanical methods to be employed are:

(1) A patch to cover the affected eye.

(2) If the function of the paretic external rectus muscle does not return in one year, the advancement or shortening of the muscle is advisable in order to lessen the field of the diplopia.

VI.—INTRACRANIAL COMPLICATIONS.

51. Blackwell, Hugh.—Report of a Case of Temporosphenoidal Abscess of Right Lobe. *Ann. Otol. Rhinol. and Laryngol.*, St. Louis, 1919—XXVIII—92.

52. Blackwell, H. B.—Perisinus and Epidural Mastoid Abscess Subsequent to Influenza. *Laryngoscope*, St. Louis, 1919—XXIX—587; *Med. Rec.*, N. Y., 1919—XCV—819.

53. Bowers, W. C.—Interesting Symptoms in Connection With a Case of Brain Abscess Operation. Recovery. *Laryngoscope*, St. Louis, 1919—XXIX—556. *N. York M. J.*, 1919—CIX—809.

54. De Caradenc, St. Julien R.—Report of a Case of Septic Sinus Thrombosis Without Involvement of the Mastoid. *J. Am. M. Ass.*, Chicago, 1919—LXXII—1288.

55. Cumston, C. G.—Pathology and Clinical Forms of Cerebral Abscess. *N. York M. J.*, 1919—CIX—810.

56. Eagleton, W. P.—Control of Hemorrhage from Large Sinuses of Brain by Invulsion of Outer Wall Into Lumen. *Med. Rec.*, N. Y., 1919—XCV—274.

57. Eagleton, Wells P.—Cerebellar Abscess. *J. Am. M. Ass.*, Chicago, 1919—LXXIII—1060.

58. Friesner, Isadore.—Report of a Case of Brain Abscess. *Ann. Otol. Rhinol. and Laryngol.*, St. Louis, 1919—XXVIII—90.

59. Good, R. H.—Extradural Irritation and Abscess. *Illinois M. J.*, Chicago, 1919—XXXVI—226.

60. Guttman, J.—Report of a Case of an Otitic Abscess of the Brain. *Laryngoscope*, St. Louis, 1919—XXIX—581.

61. Hill, Fred'k T.—Report of a Case of Spontaneous Hemorrhage from the Lateral Sinus Occurring Six Days After Simple Mastoid Operation. *Ann. Otol. Rhinol. and Laryngol.*, St. Louis, 1919—XXVIII—29.

62. Kahn, A.—A Brain Abscess Drain. *Laryngoscope*, St. Louis, 1919—XXIX—430.

63. Keeler, J. C.—Symptom Complex Complicating Acute Mastoiditis with Scarlet Fever. N. York M. J., 1919—CIX—944.
64. Kerrison, P. D.—History of an Obscure Case of Intracranial Infection with Autopsy Findings. Laryngoscope, St. Louis, 1919—XXIX—480.
65. Kopetzky, S. J.—Recently Observed Intracranial Infections Complicating Mastoiditis. Laryngoscope, St. Louis, 1919—XXIX—679.
66. McCaw, James F.—Gangrene of the Temporosphenoidal Lobe, Right Side, of Otic Origin. Operation and Extensive Incision of the Lobe. With Recovery. Ann. Otol., Rhinol. and Laryngol., St. Louis, 1919—XXVIII—823.
67. McKinney, R.—Spontaneous Recovery from Lateral Sinus Thrombosis. Laryngoscope, St. Louis, 1919—XXIX—13.
68. Robinson, J. A.—Report and Clinical Notes of a Case of Toxic Delirium Following Mastoidectomy. Ann. Otol., Rhinol. and Laryngol., St. Louis, 1919—XXVIII—86.
69. Smith, J. Morrisette.—Two Cases of Skull Fracture with Secondary Mastoiditis and Meningitis, and in One Case Brain Abscess. J. Am. M. Ass., Chicago, 1919—LXXXII—995; Laryngoscope, St. Louis, 1919—XXIX—552.
- 70.—Stickney, O. D.—Case of Bilateral Acute Suppurative Otitis Media with Symptoms of Thrombosis. Laryngoscope, St. Louis, 1919—XXIX—90.
71. Tanaka, H.—A Case of Chronic Purulent Otitis Media Complicated by Thrombosis and Suppuration of the Transverse Sinus, Extradural Abscess and Cerebellar Abscess. Operation and Recovery. Laryngoscope, St. Louis, 1919—XXIX—491.

Blackwell reports a case of temporosphenoidal abscess of the right lobe following a chronic suppurative otitis media. The interesting features brought out are:

1. In abscesses of the right temporosphenoidal lobe, occurring in right handed individuals, there is an absence of any focal symptoms, save those produced by pressure.

2. In the differential diagnosis between this condition and apoplexy, the following points are emphasized: (a) that the slow pulse of an apoplectic patient is usually increased immediately after any exertion, such as rolling over or sitting up in bed, whereas it is the reverse in brain abscess; (b) the headache of brain abscess is quite characteristic owing to unusual severity and paroxysmal nature; the headache of an apoplectic being full and steady in comparison.

3. The patient did not develop postoperative hernia due probably to (a) the comparatively small area of dura exposed; (b) no encephaloscope used, and (c) no counter openings made into the brain for drainage.

Blackwell reports two cases of perisinus abscess and one case of epidural abscess complicating influenza, from which the following observations are offered:

1. The evidences of marked local destruction in mastoiditis due to the presence of streptococcus is a significant feature of the otitic complications of influenza.

2. In considering these cases, the latent manner of development (in two there was no earache at the time of the initial middle ear infection) suggests the possibility of the presence of an unsuspected perisinus or epidural abscess in other postinfluenza patients with aural disease. The importance of otologic examination is clearly indicated by the histories of these patients, not only when earache is present, but in all cases of subjective aural disturbances accompanying and following influenza and pneumonia.

3. Finally, when operating on these patients, the writer emphasizes the importance of leaving undisturbed protective granulations overlying the sinus or brain. All macroscopic evidences of diseased bony mastoid structure should be removed. In addition to the usual technic of the simple mastoid operation, he believes in gentle curettement of the epitympanum without, of course, disturbing or dislocating the ossicular chain.

Bowers reports a case of brain abscess in a patient who had been operated for mastoid abscess by two other physicians, the first operation two months previously and the second operation one month previously. In spite of the fact that the patient complained of headache, temperature 100.3 and inability to flex the foot of the opposite side, the patient was permitted to be up and about, and was promised that the ear would be well in one week. Bowers advised reoperation, which was done and the dura exposed, but as it appeared healthy it was not incised, especially as there were no localizing symptoms of brain abscess. The first two days following the operation the patient's temperature remained at 102, then for a few days it was 101, then dropped to normal. He still complained of headache, and after the third or fourth day he began to be stupid. On the ninth day after the operation he first showed signs of amnesic aphasia, when a large temporal decompression operation was performed and the brain explored. After passing the director directly inward and upward one and a half inches the abscess was reached. At the end of two months the patient was apparently normal.

de Caradenc reports a case of septic sinus thrombosis without involvement of the mastoid.

Three weeks after the onset of a bilateral acute suppurative otitis media, following influenza and measles, and after the suppurative otitis media had been cured as evidenced by cessation of discharge and resolution of the drums with return of the light reflex, the patient presented symptoms of sinus thrombosis—chills, fever, sweats, leucocytosis, blood culture positive for streptococcus hemolyticus—but without any tenderness or pain in mastoids and no evidence of trouble in the tympanic cavity. Other diseases having been ruled out, a mastoid operation was performed on the left side, the cells and antrum found normal, but when the sinus was opened free pus escaped and the culture revealed streptococcus hemolyticus. Patient recovered.

Cumston gives an interesting exposé of the views and teachings of the French school covering the pathology and clinical forms of cerebral abscess of otogenous origin. Pathologically the lesion may be single or multiple, the site being most frequently in the temporosphenoidal lobe. These abscesses are more apt to be en-

cysted, the pus being walled off by a zone of interstitial encephalitis, which forms the so-called capsule. This capsule is thicker in the older abscesses than in those of more recent origin.

Histologically, there are three zones described, going from the center to the periphery:

(1) A zone of necrosis formed by the abscess per se.

(2) A zone of encystment which is one of defense limiting the infectious process.

(3) A zone of irritation of the peripheral structures.

The pus is sometimes a blood stained serum, but more apt to be thick, greenish in color, and with a very offensive odor, depending upon the nature of the bacterial flora. These are, in order of frequency, the streptococcus, staphylococcus and diplococcus. The latter favors the formation of a capsule.

In the majority of cases, lesions in the neighborhood consist of compression and the forcing back of the surrounding cerebral substance. There is no necrosis or direct involvement of the nervous tissue, but simply a deformation. The evolution of these abscesses can be conveniently divided into four types: (a) the first of which, infrequent, is absorption, (b) the abscess may open into the ventricles, (c) the abscess may open into the arachnoid space, (d) a progressively increasing compression from increase in the purulent contents results in a fatal issue from interference with the cerebral functions.

Concerning the clinical forms, six types are described:

1. The first and classic type is that where a patient with chronic otorrhea is suddenly taken with chills and a temperature attaining about 104, accompanied by headache and backache. There will be found a slight stiffness of the neck, occasionally Kernig's sign will be present, as well as vasomotor disturbances. Pulse and respiration normal. After a few days things return to normal. Temperature falls but the headache persists. The appetite returns but the patient becomes emaciated. Then suddenly the patient dies.

2. The typhoid form has a slow development. There is prostration, continued headache, occasionally epistaxis, with a temperature ranging around 104 degrees. Sometimes there is a mild delirium or slight aphasia. Death results.

3. The meningeal form presents the picture of meningitis as the dominating factor. The temperature is irregular.

4. The latent form presents no early phenomena of an infectious process. There are no marked motor or sensitive disturbances and a slight headache is the only complaint. Death occurs suddenly.

5. The remittent form is characterized by a less silent early phase. The patient complains of general fatigue, intellectual fatigue, headache and slight elevation of temperature. These phenomena then disappear until finally an epileptiform attack occurs and death ensues.

6. The last form is that in which the process assumes the picture of a brain tumor; slow pulse, headache, vertigo, vomiting and apyrexia.

Eagleton describes an original device for the control of hemorrhage from the large sinuses of the brain by invulsion of the outer wall into the lumen, and reports a successful operation for

cerebellar abscess by obliteration of the lateral sinus and exploration and drainage through its inner wall and anterior surface of the cerebellum.

A small opening is made in the dura on each side of the sinus and a ligature is passed from one dural opening to the other. The appliance holds the two ends of the suture apart so as not to compress the fixed dural attachments, while the descent of a metal obturator causes an invulsion of the outer wall of the sinus into its cavity, obliterating its lumen.

Eagleton has analyzed all the recorded postmortem reports of patients dying from cerebellar abscess, and while in a general way these reports justify the statement that the position of the abscess in or on the cerebellum is influenced by the route of the extension of the infection into the cerebellum, nevertheless no relation uniformly exists between the point of infection and the situation of the abscess that can be utilized surgically. Consequently to meet the surgical requirement that the operative procedure will uniformly locate the abscess or allow of its complete evacuation and the introduction of drainage material within the abscess itself, the author states that in all cases it is necessary:

1. To obliterate and doubly ligate the descending portion of the lateral sinus. This may be done by invulsing the external wall into its cavity.

2. To expose the dura of the whole cerebellar fossa of the affected side; and as the affected hemisphere occupies a position beyond the median line, the bone over the unaffected hemisphere should be freely removed.

3. To perform a ventricular puncture in order to relieve the internal hydrocephalus.

4. Then to incise the dura as far forward as possible, the incision, extending outward through the obliterated sinus and continued in whatever direction necessary.

Friesher reports a case of cerebellar abscess following an acute mastoiditis.

On the fifth day patient vomited and became stuporous, temperature 99°, pulse 40. He had involuntary stool and urination. Lumbar puncture was made but fluid was not under tension and appeared clear. It contained a few pus cells but no bacteria. Patient slowly became generally rigid, followed in twenty or thirty minutes by complete relaxation. Middle fossa was exposed, but appeared normal. On exploring cerebellum to a depth of three centimeters an ounce and a half of thick, yellow, nonodororous pus was evacuated. Patient stopped breathing and could not be resuscitated.

The interesting features were the degree and extent to which destructive lesions took place about the vital centers in the posterior fossa with no symptoms.

Good discusses extradural irritation and abscess, and makes a plea for early exposure in order to prevent those serious and fatal complications, such as brain abscess, meningitis and sinus thrombosis.

The symptoms depend upon (1) the amount of pain the patient can endure from the mechanical irritation of the sensitive dura;

(2) the severity of the infection and the extent of the edema of the dura; and (3) the degree of intracranial pressure. The symptoms of mechanical noninfective irritations, of the acute infective type, and the chronic infective type are then described in detail.

Guttmann reports a case of otitis abscess of the brain, of which the following are the interesting features:

1. At the onset of the disease the patient was treated for gastritis, the vomiting and headache being attributed to disease of the stomach. This in spite of the fact that the patient had an ear discharge for 16 years.

2. Granulations in the middle ear evidently not attached to the labyrinthine wall, were removed, and four days later temperature rose to 103, and there was severe headache and drowsiness. The lesson from this occurrence is that the removal of polyps from the ear, even when they are not attached to the labyrinthine capsule, may flare up a slumbering meningitis.

3. The radical operation was at once performed and foul smelling cholesteatomatous masses were found filling tympanic cavity and antrum; the tegmen antri seemed perforated with drops of pus oozing through the opening, which was widened, and two ounces of very offensive smelling pus gushed out. There was some improvement, but five days later the wound was reopened, and the dura found bulging. Brain was explored and two ounces of pus evacuated. Breathing suddenly stopped due to temporary interference with the circulation in the medulla. Artificial respiration reestablished breathing, but in six hours patient died.

4. The course of the affection was probably the following: Cholesteatomatous masses broke through the tegmen tympani or antri, forming a chronic brain abscess. This was quiescent, and having produced no symptoms the patient did not seek relief until the abscess caused meningeal irritation.

Hill reports a case of spontaneous hemorrhage from the lateral sinus occurring six days after a simple mastoid operation. At the operation there was disclosed a perisinus abscess, but the granulations were not disturbed. Four days after the operation there occurred a chill, with rise of temperature to 104. Two days later the first spontaneous hemorrhage occurred, due to necrosis of the vessel wall, and two days later there occurred the second chill. Ligation was then performed, but not until there was present a septicemia manifested by subsequent septic temperature and a metastatic process in the right shoulder. The attempt to demonstrate the thrombus was unsuccessful. Because of the necrosis of the sinus wall, manifested by subsequent hemorrhage, it was impossible to block off the sinus above or below, to remove a part of the lateral wall and obliterate it by compression. This resulted in a retention of the focus of infection within the vessel. Further necrosis of the wall took place, together with breaking down of the clot and subsequent hemorrhages ensued.

Hill thinks that this case bears out the generally accepted opinion that thrombosis of the lateral sinus is due to necrosis of the intima of the vessel wall, which may be manifested by hemorrhage from the sinus, and that therefore a hemorrhage is sufficient indi-

cation to operate on the sinus rather than wait for the clinical two chills and septic rise of temperature.

Kahn has devised a brain abscess drain, which is an instrument made according to the obturator canula principle. The canula or drain is made of metal and has a round, smoothly screwed surface—the train is mounted on a leader or opturator—the leader being round and blunt at one end and having a thumbscrew at the other end. When the brain abscess is located, the canula, mounted on a rod, is screwed into the abscess cavity; the leader is now withdrawn, leaving the canula. The abscess cavity can now be packed with gauze through the canula opening. As the cavity heals, the canula can be unscrewed a little at each dressing, until it is finally withdrawn.

Keeler reports a rather virulent attack of acute mastoiditis following scarlet fever, with extension of the infection to labyrinth, cerebellum and meninges. The intracranial complications became manifest about three days after the simple mastoid operation. Opening the labyrinth and draining the pus from the cerebellum brought about a cure.

Kerrison reports a fatal intracranial infection which was diagnosed only after death. The autopsy revealed a sinus clot apparently of rather recent formation, extending from near the torcular to a point near the jugular bulb. Free pus was found between the dura and right lobe of the cerebellum, which also showed well marked cortical changes, apparently of longer duration than the sinus clot. The presence of a complicating erysipelas obscured the clinical picture so that a brain operation was not indicated by the symptoms present, unless it would have been the bradycardia which was present. However, this cleared up at the cessation of the erysipelatous attack.

Kopetzky discusses some intracranial infections complicating mastoiditis which presented symptoms unusual in character and open to differing interpretations by well qualified surgeons and neurologists. There are four cases of sinus thrombosis reported; also one case each of cerebellar abscess and of meningitis sympathica.

Of the cases of sinus thrombosis two were in children, the youngest thirteen months of age; and of these one was tentatively diagnosed as pneumonia, and the other as presenting a temperature caused by absorption. This case was treated expectantly until a beginning rigidity of the neck warned of the advent of serious meningeal involvement; and the examination of the cerebrospinal fluid just prior to operation revealed that there was a meningitis already purulent in character. One of the adult cases presented a sinus thrombosis so extensive as to prove inoperable, and this developed, even though he was under competent observation during the entire period of his illness. He was never sick enough to be in bed until seen the day prior to operation, and even then it needed considerable urging to convince him to submit himself to operation. The fourth case was one which did not present any symptoms referable to sinus thrombosis. He did present an almost classic picture of cerebral abscess, and his case was thus diagnosed by competent neurologists.

The case of cerebellar abscess presented itself with no characteristic signs until the terminal stage of the patient's illness. He had a negligible middle ear picture and a tentative diagnosis of encephalitis lethargica had been made. When the clinical manifestations as they finally were evolved were considered in connection with the few drams of pus evacuated from the cerebellum, one could hardly comprehend them as factors constituting cause and effect. The remaining case was one of chronic mastoiditis, presenting itself during a stage of subacute exacerbation. In this case otoscopic examination failed to reveal any evidence of the finding of a large cholesteatoma involving the middle ear and mastoid process. The patient had had competent otologic supervision prior to coming under the author's supervision. A few hours after operation the patient developed signs of a rapidly increasing intracranial pressure, and his vital centers in the medulla were evidencing increasing difficulty in functioning. Prompt recognition of the condition and equally prompt decompression operation—at which nothing more than an edematous condition of the meninges and brain tissue was found—probably saved his life. The clinical picture of a man, in violent mania, confined in a straightjacket, with Cheyne-Stokes respiration developing a few hours after radical mastoidectomy, remains as yet unexplained. Striking indeed was the prompt remission of all these symptoms upon decompression.

A detailed report of the cases with comment is added.

McCaw reports a case of gangrene of the temporosphenoidal lobe complicating a chronic suppurative otitis media. The otitis media had been of twenty years' duration with acute exacerbation. During one of these exacerbations, operation was performed and the dura appeared greenish and gangrenous. Incision of dura revealed similar condition of brain, so with forceps and scissors the greater portion of the temporosphenoidal lobe was cut away. It was of the consistency of soap and of a greenish, gangrenous condition throughout. There was no bleeding. Normal brain tissue was not entered. The excavated cavity in the brain was three inches inward and three and a half inches forward from the surface of the wound. Patient made an uneventful recovery and his mental and moral status was greatly improved. From a mental and moral pervert he was restored to the community as a reliable and fairly good citizen.

There was a small cerebral hernia about one-half inch in all diameters, for which the following plastic procedure was done two months after the original operation. The flaps were elevated thoroughly and the entire wound lightly curetted. A flap was fashioned from the posterior flap of the mastoid wound, including the periosteum and overlying tissues except the skin, cut free at its lower part, carried upward and forward and sutured to the periosteum at the upper and anterior part of the wound. This flap acted as a suspensory and covering to the hernia, giving it support. Another flap was made from the posterior auditory canal so as to enlarge the meatus, and this was carried upward and backward, being sutured to the upper part of the posterior wound flap, thus giving further support to the hernia.

McKinney reports a case of suppurative otitis media for which

a mastoidectomy was done. Subsequently there developed metastatic abscesses on the shoulder and at the end of the spine, as well as rigors and a temperature course that were typical of sinus thrombosis. Evidence of any other kind was lacking. Twelve days after the mastoidectomy it was decided to explore the sinus. The sinus wall was thickened and grayish, but a slight pulsation was noticeable. Because of his weakened circulation, nothing more was done and patient returned to his room. Immediately following this exposure, and temperature dropped and ran an almost flat course from that time on, and the patient made an uneventful recovery. The question asked by the author is: What bearing did the removal of the overlying bone have on the recovery by crisis, or was this merely coincidental?

Robinson reports a case of toxic delirium following mastoidectomy. The trouble started two days after the operation and was still present six weeks later. At first the patient was slightly irrational but later developed delusions of persecution, at one time attempting to throw herself out of the window.

In studying the history of this case, the following facts were brought out:

1. The patient had always been recognized as a highly nervous woman and was within a few years of the menopause, and therefore more likely to be stimulated by toxemia of any nature.

2. The delirium developed early in the course of her convalescence.

3. The gouge was not employed except for the removal of the cortex, which was not unduly hard.

Robinson views the case as one due to absorption products from the mastoid, especially as the patient had been in urgent need of operation for two weeks. The operation, the fear of the procedure, the duration, the discomfort of the drainage and the postoperative treatment are all etiologic factors acting upon a nervous patient.

In order to lessen the chances of this complication the following measures are advocated:

1. Early operation, if pain is not relieved by prompt myringotomy and appropriate treatment.

2. A minimum use of gouge and mallet.

3. The use of nitrous oxid in doing the first dressing on a highly nervous patient, and subsequent dressings to be made as painless as possible.

4. A constant surveillance should be maintained over a patient who manifests early nervous derangement, so as to prevent bodily harm.

5. Free patient from all sources of irritation, have diet nourishing and attend to elimination.

Smith reports two cases of skull fracture with secondary mastoiditis and meningitis, and in one case brain abscess.

In the first case the mastoid cells were thoroughly exenterated, the patient dying two days later with meningitis.

In the second case the mastoid cells were not exenterated, only the cortex was removed, avoiding the use of hammer and chisel. This patient made a temporary recovery, going home and being

apparently well for three months, when symptoms of brain abscess appeared. Pus was evacuated from the frontoparietal region, and in three weeks death occurred from meningitis.

From this experience the author advises against complete excision of the mastoid cells so as not to interfere with the protecting wall of granulations along the line of fracture.

Stickney reports a very interesting case of bilateral acute suppurative otitis media with symptoms of sinus thrombosis. A bilateral simple mastoid operation was performed and sinuses exposed but no thrombus suspected. After operation patient had chills, remittent temperature, swelling of right elbow from which pus was obtained and the streptococcus isolated, this being the same organism as was recovered from the mastoid. The blood examination seemed conflicting, because while the blood picture improved, the patient became worse. Finally both sinuses were incised, and though there was bleeding from the right, it was not as free as normal, hence the internal jugular vein was ligated and a portion resected. The left sinus was explored and free bleeding occurring from both ends, the vein was not disturbed but the pressure to stop the flow of blood produced the same effect as a bilateral ligation of the internal jugular vein. In spite of this, the patient exhibited no evidences of increased intracranial pressure. Eye-grounds remained normal and patient made a good recovery.

Tanaka reports a case of chronic purulent otitis media in a girl 14 years of age, which was complicated by thrombosis and suppurative of the transverse sinus, extradural abscess and cerebellar abscess. Several operations were performed in an attempt to eradicate the suppurative focus in the brain, and finally, after all hopes and the patient had been given up, the focus was discovered and the patient recovered. The course of the disease is presented by daily notes for which the original article will have to be consulted.

VII.—DISEASES OF THE INTERNAL EAR.

72. Goeckermann, W. H., Barlow, R. A., and Stokes, J. H.—The Diagnostic Value of Lowered Bone Conduction in Syphilis. *Am. J. Syphilis*, 1919—III—240.

73. Hoshino, T., and Shimasaki, S.—Impaired Hearing Following a Paralysis of the Nervus Abducens. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919—XXVIII—489.

Goeckerman, Barlow and Stokes present the following conclusions relative to the diagnostic value of lowered bone conduction in syphilis:

1. The so-called lowered bone conduction test (reduction in conduction of sound by bone as compared with otherwise normal hearing) is positive in 78 per cent of known syphilitics in our series.

2. From the otologic standpoint the test is only of value if a complete hearing test is done.

3. The efficiency of the test varied greatly in different types of syphilis, being at its best in late cutaneous syphilis (100 per cent), latent syphilis (80 per cent), syphilis of the central nervous system (80 per cent). It had almost no value in osseous lues, and the results in early syphilis were inconclusive (too few cases). A neg-

ative Wassermann test combined with a negative bone conduction test is strong evidence of the absence of syphilis.

4. The test agrees with the positive or negative diagnosis of syphilis in 67 per cent and disagrees in 33 per cent.

5. The test was also positive in 48.7 per cent of patients in whom syphilis could apparently be excluded.

6. It has, on the whole, therefore, only a restricted value as a diagnostic aid, owing to its high factor of error.

Hoshino and Shimasaki report a case of impaired hearing and tinnitus followed in the course of paralysis of the abducens nerve, in which there was no apparent focal infection or any disease of the middle ear and its related structures.

The salient features as summarized by the authors are:

1. The subject had hearing disturbances of high pitched sounds, tinnitus of high character, and hyperesthesia in the region of distribution of the trigeminai nerve, in the course of an abducens paralysis, all occurring on the same side, and in a little less time than two weeks.

2. Accurate examinations of the middle ear and its related structures and the internal ear showed normal condition.

3. All symptoms from the abducens, trigeminal and cochlear nerves must have been caused by the syphilitic affection.

4. The localization of the lesion in this case may be supposed to be in the meninges behind the petrous portion of the temporal bone, and involving those portions which are pierced by these three nerves.

VIII.—INJURIES.

74. Cutler, F. E.—Injuries of Auditory Canal Resulting from Projectiles. *Laryngoscope*, St. Louis, 1919—XXIX—82.

75. Neuhof, H., and Cocks, G. H.—Remarks Upon the Treatment of Gunshot Wounds of the Mastoid. *Laryngoscope*, St. Louis, 1919—XXIX—615.

Cutler presents an instructive contribution to the subject of injuries of the auditory canal resulting from projectiles, with special reference to the separation of the cartilaginous from the bony canal.

The author roughly classifies injuries of this character as follows:

1. Injuries to the cartilaginous membranous canal.

2. Injuries to the bony canal.

3. Injuries to the cartilaginous membranous and bony canal.

4. Separation of the cartilaginous membranous from the bony canal.

The smooth penetrating bullet wound which injures the cartilaginous membranous canal at its external beginning, heals frequently without undue symptoms and without stenosis of the canal. The deeper smooth penetrating bullet wounds, the nearer they are to the bony meatus, the more apt they are to form stenosis or atresia.

The wounds of the cartilaginous canal are nearly always accompanied by splinter fractures. The result of these injuries after the splinter comes away, in the course of a prolonged suppurative process, can in nearly every case be prognosed as a greater or lesser stenosis. The more severe and larger lesions of the bony and car-

tilaginous canal occur only with greater injuries in the immediate neighborhood from shrapnel or shell. Injury of the temporo-maxillary joint and facial nerve frequently occurs in connection with this injury, as well as injury to deeper structures of the ear.

The type of injury in which the cartilaginous membranous canal is separated from the bony canal is produced by the bullet dissecting the cartilaginous from the bony wall on the under surface.

In these cases one finds on the border between the cartilaginous and the bony wall a typical semilunar granulating ridge, springing from the floor and anterior wall and projecting prominently into the lumen of the canal. The result of these injuries in the absence of treatment is usually a greater or lesser stenosis and at times even a complete atresia. In recent cases skillful tamponage is indicated. In old cases already stenosed, laminaria tents are used. For complete atresia operation is indicated. If complicated with a discharge from the middle ear a plastic operation with complete removal of the posterior bony canal wall is recommended. In case of atresia of the cartilaginous membranous canal alone, several methods have been attempted:

1. Excision of the scar with Thiersch skin graft.
2. Crucial incision through the scarry septum, forming four triangular flaps which are inverted and pushed inward.
3. Excision of the scar tissue and covering the denuded area with skin flaps from the vicinity.
4. The method successfully employed by Ruttin. This consists in cutting through the external ear at its basilar attachment and removing the scar tissue which caused the atresia, taking a skin flap from the mastoid process and drawing it through the incision, placing it with a thin spatula, so that it forms the posterior wall of the meatus. The granulations of the other walls are held in check with tamponage.

The author gives one case report out of the many which he had the opportunity of observing.

Neuhoff and Cocks discuss the treatment of gunshot wounds of the mastoid and state that the method of treatment depends upon whether the patient is operated early, before the onset of wound contamination or definite infection, or whether he is first seen after the wound is suppurating.

1. Operation in the first state, before wound infection, embraces
 - (a) Excision of the wound.
 - (b) Removal of in-driven bone fragments and foreign bodies, and damaged portions of the mastoid.
 - (c) Closure of the dural tear by suture or by fascial transplant.
 - (d) Primary closure of the wound.

The complication of laceration of the lateral sinus is treated by "postage-stamp" graft or ligation of the sinus, depending upon its extent. Larger lacerations of the sinus are treated by double ligation.

2. Treatment at the base, after wound infection, includes
 - (a) X-ray for additional foreign bodies.
 - (b) Incision and drainage of the bone wound, with complete extirpation of the mastoid cells.
 - (c) Employment of Carrel-Dakin technic.

IX.—EDUCATION OF THE DEAF.

76. Goldstein, M. A.—Present Status of the Teaching of the Deaf. *Laryngoscope*, St. Louis, 1919—XXIX—503.

77. Kessler, Emma B.—The Aurist and Lip Reading. *Laryngoscope*, 1919—XXIX—163.

78. Richardson, Chas. W.—Organization of the Section of Defects of Hearing and Speech. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919—XXVIII—421.

Goldstein in discussing the present status of the teaching of the deaf draws attention to the influence which properly educated teachers have in promoting pure oralism and makes a plea for co-operation of all interested in this work in order to secure enactment of laws for protection and education of those with defective hearing and defective speech.

Kessler deplores the fact that many incurably deaf patients are not told of the benefits of lip reading and urged to take up this study, especially while a small amount of hearing is still present.

It is a great indictment of the aurist to be informed that "from among fifteen persons who are more or less deaf, and who have recently become enthusiastic lip readers, only three had heard of speech reading through their aurists."

Richardson discusses in considerable detail the plan of organization of the section of defects of hearing and speech of the division of physical reconstruction, and adds a summary of all cases treated up to May 31, 1919.

X.—MISCELLANEOUS TOPICS.

79. Amberg, Emil.—Treatment of Ear Diseases in the Light of Medical History. *J. Michigan M. S.*, Detroit, 1919—XVIII—521.

80. Blackwell, H. B.—Diagnosis of Earache. *N. York M. J.*, 1919—CIX—1076.

81. Burns, Stanley S.—Some Unusual Cases Met With in Ear, Nose and Throat Service in a Base Hospital. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919—XXVIII—73.

82. Dean, L. W.—Report of a Case of Suppurative Labyrinthitis and Tuberculoma of the Cerebellopontine Angle, Cerebellar Abscess, With Miliary Tuberculosis of the Lungs, Spleen, Kidneys and Intestines. *Ann. Otol., Rhinol. and Laryngol.*, St. Louis, 1919—XXVIII—514.

83. Dean, L. W., and Armstrong, Margaret.—A Case of Fibrosis of Tissues Lining the External Auditory Canal and Tissues Overlying the Mastoid. *Laryngoscope*, St. Louis, 1919—XXIX—365.

84. Graham, H. B.—Frequent but Neglected Evidences of Syphilis From the Side of the Nose, Throat and Ear. *Am. J. Syph.*, 1919—III—26.

85. Leiner, J. H.—Etiologic Factors Bearing on Therapeutics of Bell's Facial Palsy. *Med. Rec.*, N. Y., 1919—XCV—319.

Amberg discusses the treatment of ear diseases in the light of medical history and comes to the conclusion that our progress has not been as great as we are wont to believe and that much of the present day knowledge was possessed by the ancients.

Blackwell presents a concise classification of the various conditions producing earache, and discusses some of the different points so that the general practitioner may be aided in making a prompt and proper diagnosis. Four types are presented:

1. Earache due to an inflammation behind the tympanic membrane.
2. Earache due to an inflammation in the soft parts of the external auditory canal.
3. Earache due to an inflammation, but produced reflexly from teeth, nose or throat.
4. Earache largely mechanical in origin, occurring chiefly in infants and at night. The prone position increases congestion of the nasopharynx; the eustachian tube is closed; a vacuum is produced in the middle ear; child cries from pain; tube opens; relief occurs.

Burns reports a case of dermoid cyst behind the auricular attachment of the left ear which was discharging. Two previous operations gave no relief. The sinus was injected with methylene blue solution and upon distention was found to be connected with a cavity one centimeter in diameter, which was directly posterior to the external auditory canal wall. Under cocaine anesthesia the sinus was followed up and sac removed. Examination of the interior of the sac revealed small downlike hairs and several small cartilaginous bodies. No symptoms of recurrence after two months.

Dean presents a detailed case report of a suppurative labyrinthitis and tuberculoma of the cerebellopontine angle and cerebellar abscess, in which the symptomatology was in accordance with the accepted conceptions of labyrinthine and cerebellar symptoms, except in one thing: With a labyrinthine nystagmus to the left and a cerebellar right sided lesion, the patient was always most comfortable lying on the right side.

In closing, the author advises that in intracranial lesions with chronic paranasal sinus disease or chronic mastoiditis, we should always keep in mind the possibility of a tuberculous bone lesion and tuberculosis of the brain.

The postmortem in this case revealed tuberculous meningitis.

Dean and Armstrong report an interesting and unusual case of fibrosis of tissues lining the external auditory canal and of tissues overlying the mastoid. The ear projected almost at right angles to the head with a swelling over the mastoid which, however, felt like a polyp. Operation revealed a large mass of fibrous tissue which was partially removed. A few months later the deformity recurred, so that another operation was performed, at which time the fibrous tissue was extensively and completely removed. All of this trouble was dated to ten years previously, when the ear was pulled, giving the feeling that it was being torn from the head.

Graham in discussing the frequent but neglected evidences of syphilis of the ear, does not mention the common well known diagnostic features, such as the ulcerations and necroses due to the thromboses of the veins on account of the pressure of the small round cells, but on the contrary he draws attention to symptoms often overlooked, due to the deposit of small round cells per se.

As to the character of the discharge from the middle ear, a thickropy discharge without pain is significant.

Cochlear symptoms suggestive of syphilis are:

1. Shortened bone conduction.
2. Probable lateralization.
3. Rinne positive, in the presence of impaired hearing.
4. Islands of hearing demonstrable.
5. Tinnitus.

Vestibular symptoms suggestive of syphilis are:

1. Progressive reduction of the nystagmus time (below 26 seconds) after turning, or reduction remaining constant in the presence of other evidence of syphilis.
2. Absence of a turning reaction with a caloric reaction present or vice versa.
3. Irregularities in the reactions between the vertical and horizontal canals.
4. Vertigo present without nystagmus or exaggerated after turning, or caloric nystagmus without vertigo.

The main characteristic in all is the disharmony existing between them.

Leiner discusses the etiologic factors bearing on the therapeutics of Bell's facial palsy. The following points are emphasized:

1. Bell's facial palsy occurs more frequently on the right side.
2. It occurs twice as frequently in the female as in the male.
3. It is more frequently present between April and September.
4. The primary etiologic cause is exposure.
5. Counter irritation should be the earliest, and it also is the best remedy, if the case is a primary facial palsy.
6. All electricity should be immediately stopped when the first symptoms of contracture appear.

7. Electricity (galvanism) is the only treatment in chronic cases, and should be employed even up to a year after the onset of the paralysis, providing there is no tonic contracture of the musculature.

SOCIETY PROCEEDINGS.

NEW YORK OTOLOGICAL SOCIETY.

Annual Meeting, November 25, 1919.

PRESIDENT DR. T. J. HARRIS.

Dislocation of the Stapes in the Radical Mastoid Operation.

Dr. J. D. Richards: I have recently had a case of accidental dislocation of the stapes which I would like to report, simply to emphasize its dangers. It occurred during an ordinary radical operation. I think I was somewhat to blame for it, in that the facial ridge had been lowered very near to its limit before the tympanic cavity was cleared out. This exposed the stapes to injury by sponging. Following the operation, there was noticeable nystagmus, but there was no immediate rise of temperature. There occurred later, after a period of about three days, headache which was very severe; the nystagmus gradually subsided. Deafness had become practically absolute, but at the end of about fourteen days, patient complained of very severe headache. A spinal puncture was made, the result showing a pure streptococcus infection of the fluid. I operated immediately—that is, two weeks after the original radical operation and the date of the accidental stapes dislocation, upon opening the modiolus there was an escape of actual fluid pus through the internal auditory meatus. The intracranial cavity in this instance was drained through the internal auditory meatus. I have seen a number of these cases now, and many of them run no temperature subsequent to the accident until symptoms of meningitis ensue. We are liable to let those cases go without draining the labyrinth immediately in the hope that intracranial infection will follow. I have now come to the conclusion that it is safer in accidental stapes dislocation during the radical operation, without waiting for symptoms to develop, to open the vestibule, that is to remove the outer vestibular wall at the time that the accident occurs. The promontory corresponding to the first cochlear whorl should be removed also.

I would like to get an expression of opinion from other members of the society in regard to their experience with this accident.

I might mention that the stapes was dislocated in this case by the assistant sponging too vigorously over the site of the stapes. As the facial ridge had been lowered to its absolute limit before the tympanum had been cleared out, it can be readily understood that this accident was more likely to occur than if the ridge had not been lowered to such a degree until later in the operation.

Dr. Kerrison: The whole literature bearing on Dr. Richards' deductions supports the view he has expressed—i. e., that a surgical

accident to the stapes during a suppurative lesion is one of the most dangerous that can occur.

We all remember, I suppose, that Dr. Jack of Boston many years ago reported quite a series of cases in which he removed the stapes in nonsuppurative lesions for the improvement of hearing; and while this procedure has not appealed to otologists as a rational one, his results did seem to prove that removal of the stapes is not particularly dangerous so long as strict asepsis can be maintained. But removal of the stapes, or rupture of its annular ligament during a suppurative middle ear lesion admits pus or infective matter into a vestibule in which no protective barrier have been set up to guard the meninges; and I agree with Dr. Richards that immediate surgical drainage of the labyrinth is a logical step, and is the best safeguard, though not a perfect one, against invasion of the meninges.

Dr. E. B. Dench: It has always been my practice during a radical operation to explore the oval window very delicately with a fine middle ear probe, because I know that very frequently crura and the head of the stapes will be found wanting, and yet the vestibule closed by the footplate of the stapes. Whenever I can't see the head of the stapes perfectly at the end of my operation, I always take my fine middle ear probe, and simply palpate lightly the region of the oval window. If my probe doesn't enter the vestibule, then I pay no attention to the accident whatever. If the oval window is not open, I never feel any hesitation about using a primary graft. If the oval window is open, naturally, I never graft a case of that kind, but I do pack off, and I have been fortunate enough not to have had the untoward effect that Dr. Richards mentioned.

In one case of that kind, in which I have forgotten whether the stapes come out or not, I found the oval window open. I packed off in the way I described, and eight days later did a secondary grafting operation. That man made a perfect recovery. I had one case where during a myringotomy I think that I hit the stapes and the patient became deaf, but luckily had no other untoward symptom. That was bad enough. It is a mystery to me that this accident does not happen more frequently.

I always warn the assistant in sponging, and point out the stapes to him at a very early stage of the operation; and in certain cases where I have very good hearing, I even pack over the region of the oval window with a small cotton pledget so that the sponge of the operator will not come in contact with the stapes. Considering the number of radical operations that are done, I think there are very few accidents of this kind reported.

Regarding the advisability of doing an immediate labyrinth operation from my own experience I wouldn't advise it. I think it is safe, and yet I don't see why it is very much safer than it is to pack off the oval window as I suggest. I don't see why we should open up, for instance, the first two turns of the cochlea and the semicircular canals, instead of packing off the one area and trying to isolate it.

I think what Dr. Richards says is very true, but I should rather hesitate, however, to take out every labyrinth where the stapes is dislocated. I would like to ask Dr. Richards, at the time of the

operation, whether he actually found the oval window open, or whether it was closed.

Dr. Richards: The stapes was dislocated, and seated on the promontory after the sponging was done.

Dr. Dench: Was the window closed?

Dr. Richards: The stapes came out as a whole.

Dr. Dench: At the same time there is usually a thin layer of membrane which occludes the oval window even if the stapes is dislocated.

It takes a good deal of force to dislocate a stapes. I rather think that Dr. Richards is blaming himself a little too much, as far as the result is concerned.

The Chairman: Can you tell me how many times the accident has happened in your practice?

Dr. Dench: The first case I remember very vividly, because I was very much worried about it, and since then I should say that I had seen two or three other cases. Two of those cases made complete recovery, but these are the only two cases I remember where the vestibule was actually open at the time of the operation.

In a great many cases I have seen the crura and the head absent and the oval window closed. In all of Dr. Jack's cases, where the stapes was extracted in nonsuppurative otitis media there was no perilymph flow because the vestibule is normally closed by a thin membrane. I think Sommering the first to point this out.

Dr. Friesner: From my own histologic studies, I never believed that there was any membrane internal to the foot plate. There is a membrane or rather a ligament around the foot plate, but I don't think there is any internal to it, except the endosteum. I am sure from my dead house experience that very frequently in doing a radical mastoid operation the crura of the stapes must be broken and I don't think that it makes any difference.

Dr. Richards omitted one point that, I think, is very important. In teaching men operative surgery, I insist on them learning to sponge in one way, sponging in the middle ear in a radical mastoid. That is, I make them sponge toward the tube, keeping absolutely away from the posterior part of the cavity; and in cleaning out the cavity—for instance, very frequently right after the bridge is broken down, the middle ear is full of granulations, I teach them to put the curette in the region of the tube, and sweep it downward and backward over the cochlea to the floor. That, to my mind, is the only safe way to clean, and the only safe way to sponge the middle ear.

A number of years ago in a very short time I saw three cases in which the stapes was dislocated during a radical mastoid operation. They all developed acute labyrinthitis. One of them developed a suppurative meningitis and died. The other two recovered, of course with total loss of function. I think if such a thing happened to me I would be perfectly willing to take counsel with regard to whether or not to open that labyrinth and it seems to me I would hesitate at the time of the operation to subject that patient to further operative procedures on the labyrinth. The foot plate of the stapes is practically the entire outer wall of the vestibule and when the stapes is out the vestibule is fairly well open.

I would like to hear from Dr. Richards as to how much more he would do, whether he would simply open into the vestibule through the external canal and quit there or whether he would take off the promontory.

Dr. Page: I had a case similar to this. The child, about eight years old, was brought into the clinic with an apparently acute labyrinthitis. It was staggering and very sick, nauseated. No tests were made at the time, except to note that it had no hearing. Noise apparatus was put in the left ear and no hearing was present in the right. The child couldn't distinguish between a shout and a loud whistle. It was put to bed and kept quiet and developed no complications. At the end of three weeks when he was walking around the ward he was told that his mother could take him home and bring him back for a radical mastoid operation later. The tests, at this time, after his acute symptoms had subsided, showed negative caloric and absolutely no hearing in the right ear. No rotation tests were made. He was brought back, probably six weeks later—I don't know the exact time, but it was at least six weeks after—and it was found that his hearing had returned. He heard a whisper at six inches with a noise apparatus in his other ear, and we found that he had a sluggish but a positive caloric reaction.

Then the radical mastoid was done on him, and a cholesteatoma was found in the antrum and attic and tympanum. When this was removed, the stapes was brought into plain view. I touched the stapes with an attic probe, demonstrating it to some students; when I touched the stapes it fell over and came away intact and left a pit, into which the membrane of the cholesteatoma continued. The upper posterior quadrant of the inner wall of the tympanum was covered with an epithelial layer from the cholesteatoma, from the sheath, or the capsule of that cholesteatoma. It acted as a skin graft and it has been left there, and there was so little tendency for granulations to form that no packing after the first twenty-four hours was put in the cavity. It was washed out with a Dakin's solution every two hours. The niche can still be seen and a closed oval window with this white membrane lying over it. He was not disturbed afterwards, and he has hearing in the ear still.

Dr. McCoy: It seems to me that the reports of these cases of dislocation of the stapes indicate that it may result in either one of two conditions: A serous labyrinthitis, with a resultant complete loss of hearing, or a purulent labyrinthitis. As far as I can recollect, in reading the statistics of the condition, the majority of the cases develop a serous labyrinthitis with simply the loss of hearing, but a certain proportion develop the purulent labyrinthitis.

Now, we have no means of determining, as far as I can tell, just how it is going to turn out, whether it is going to be a purulent labyrinthitis with meningitis or a simple serous labyrinthitis, and until we have some such method, I think it would be better surgery to open the labyrinth and give as full and free drainage as we possibly can get.

Dr. Richards: Whether we propose to merely open the labyrinth in cases of this character or to do an exterior removal of the

labyrinth capsule we must remember the fact that the infection confines itself to the fluid; there is no bone involvement. To remove the semicircular canal system is altogether unnecessary; as it has no important connection with the intracranial cavity except by way of the vestibule.

If we propose to open the labyrinth, we should open both the outer vestibular and cochlear wall; we cannot drain the cochlea by draining the vestibule except imperfectly; so the outer wall should be removed also. It is through the cochlea or modiolus that the greatest danger to intracranial infection lies.

The dislocation of the stapes in a pure radical operation for chronic suppuration is, without doubt, a very serious accident; it is a question of life and death; from what I have seen, I would place the mortality at about fifty per cent. Of course, that experience is very limited, but we are confronted with a very grave danger of meningitis.

My own feeling in the matter is this: I consider it the proper thing to do when the stapes is accidentally dislocated during the radical operation for a chronic suppurative ear, to immediately remove the outer vestibule and cochlear wall without waiting for further developments.

Dr. W. H. Haskin: I would like to make one suggestion, which I think is really a very valuable one in doing radical surgical operations, and that is to use suction in keeping the cavity clean, especially when working in the middle ear cavity. Force is unnecessary; also sponging. The cavity can be kept absolutely clean by holding the catheter with the left hand. The whole field can be clearly seen.

Brain Abscess.

Dr. McCoy: The patient who came into my service in the New York Eye, Ear and Throat Infirmary last spring, was sent in from a clinic with a history of chronic suppuration in the ear, of fifteen years' duration. The night of the afternoon that he came in, he seemed to be in a very irritable condition of mind. He got into a fight with several of the patients and finally with the orderly, and insisted on leaving the hospital early the next morning. He was sent in for operation on the next day. We didn't hear anything more from him for three or four days, and he was then brought into the hospital, I might say, carried in in rather a stupid condition. He had a slow pulse, temperature was about 100. We took some of his spinal fluid, which later showed a cell count of about 800, and that afternoon a radical mastoid was performed. We searched for a symptom possibly leading to his brain, but could not find it. He was returned to bed for further observation, and the next day his mentality was quite normal. His pulse remained slow, and he was then tested for focalizing signs, and he had a very typical aphasia of the sensory type; that is, when shown a watch, he knew what it was, but he couldn't tell what it was; when shown a pencil, he knew what it was for, but he couldn't say the word "pencil." His mind was very clear. He would say, "That is very funny, I know what that is, I know perfectly well what that is, but I can't say it."

So we watched him for another couple of days, and finally decided to explore his temporosphenoidal, but without result. He was returned to bed, and gradually his cell count increased. Bacteria appeared in the spinal fluid and about five days after the operation he passed away.

I was particularly interested to see why I had missed locating the pus in his temporosphenoidal lobe. We reopened the wound and explored the brain, and in taking out the brain section by section, we took out the entire temporosphenoidal lobe, with no sign of pus whatever. We cut forward, however, and in taking it out layer by layer, we came upon an abscess about the size of a pigeon's egg, which was lying directly upon the posterior wall of the frontal sinus. It made me think that perhaps this man had a chronic suppuration in his accessory sinuses which I had overlooked and possibly here was a frontal sinus abscess as a result of suppuration, so I immediately explored his frontals and found them perfectly normal. So here was a case which presented the typical symptoms of pressure on the third frontal, but instead of coming from the back it came from the frontal backward.

And it struck me at the time that if a man has explored the brain thoroughly and cannot locate the abscess, that it might be well for him to go forward and explore the frontal. In speaking with Dr. Whiting about the case afterwards, he said that he had had a similar case at the Mount Sinai. He had explored the temporosphenoidal very thoroughly, and couldn't find the abscess, and the neurologist at Mount Sinai asked him to explore the frontal. He took away a section of the frontal, and still could not find an abscess, but an autopsy was performed on that case, and it developed that there was an abscess in the frontal lobe.

Syphilis of the Auricle.

Dr. McCullagh showed a photograph of a case in which the lesion was due to syphilis and which yielded to one dose of salvarsan.

Sinus Thrombosis with Secondary Sinus Thrombosis Extending to the Other Side.

Dr. W. P. Eagleton: This is a case of sinus thrombosis, with a secondary sinus thrombosis extending from the one sinus around to the opposite (chronic in nature) then through the inferior petrosal sinus, then into the neck, causing an abscess of the throat, and treated all this time for restrictive strumitis, because of the abscess being in the throat.

The man was a married man, thirty years of age, and he had been suppurating on and off all his life. He was in his usual health until November 8, 1918, when he complained of right sided earache. On November 19th he vomited after taking some medicine, and was dizzy after having his ear syringed. At this time he had a chill lasting half an hour—remember this was November 19th, and the man died sometime in January. He had another chill on November 27th. He was seen on December 1st by a new family physician who said he had grip. His temperature at this

time was 104 and it continued high until five days had passed, and then he got up and went to business. On December 6th he had another chill, and he was still attending to his business. On December 14th, he consulted an oculist, saying: "I see double." The man at this time was going to work, and going to and from the doctor's office, although he had had a number of chills. On December 20th he went to another eye specialist, who reported paralysis of external rectus of right eye; he did not look at the man's ears. On December 27th he returned to his family physician, and went to his office and said he did not feel well, that this double vision bothered him.

On January 2nd, 1919, he went to the same physician, complaining of very severe headache and general itching; he still had diplopia. This was six weeks since the time he had the first earache, or a recurrence of his old trouble. On January 8th he went to Dr. Corwin's office, and Dr. Corwin, after an examination, said he thought the man had an abscess in or near the brain, and told him to go to the infirmary. He didn't feel sick enough to go there, so he went home. He walked home again, about fifteen blocks in all. His wife said during all this time he had had, off and on, nightly chills, and would sleep a good deal. He would go to sleep at any time during the day while sitting in a chair, but felt fairly well, except for progressive weakness during the day. At night he would have chills.

On January 9th, a general physician in Newark described the case to Dr. Barkhorn, saying that the running ear had been emphasized for the first time on that day, that is, that it was the first time that the thought had occurred that the trouble had come from the ears. Dr. Barkhorn, from the early description thought the man had general ear symptoms, running ear, paralysis of the sixth nerve on the same side, and Gasserian pain.

On the 9th of January, Dr. Barkhorn saw him. He could not make a thorough examination, but found two discharging ears, a large fluctuating mass in the right nasopharynx, and a paralysis of the right sixth nerve in a patient who looked now severely ill. He was yellow in color, was mentally alert, but talked through his nose. Wife said he had pain on swallowing since January 6th. Dr. Barkhorn advised him to come to the infirmary at once. He did not come there until the following day at 3 P. M., January 10th, at which time Dr. Barkhorn made the following notes:

General condition negative except that he looks severely ill, almost typhoidal. Systolic blood pressure, 170; diastolic, 110; bilateral complete paralysis of the sixth nerve, partial paralysis of the right third nerve; bilateral choked disk. He has a swollen and tender gland under the right mastoid, right mastoid tender, but has almost complete destruction of both drums; large fluctuating mass in right nasopharynx; temperature 100; pulse 96; respiration 30. Chief complaint on swallowing and spits a large quantity of grumous material, which increased after manipulation of nasopharyngeal mass. Heard with both ears, with the noise apparatus; each ear tested separately.

As I could not imagine an ear lesion giving a bilateral sixth lesion and a partial right third with a mass in the nasopharynx—

these are Dr. Barkhorn's notes—I decided it was an empyema of the sphenoid pointing into the nasopharynx.

At this time I saw the patient with Dr. Barkhorn, and he said: "Let us incise this abscess." I rather doubted whether there was any pus there, but I said, "Go ahead, incise it." He incised it and Dr. Barkhorn's notes show that he got over an ounce of pus, examination of which showed a mixed infection mostly pneumococci. Bare bone could be palpated extending upward to base of skull. The temperature remained about 100 until the evening of January 11th, when it suddenly jumped to 104.

January 12th, nasopharynx palpated; mass was gone; incision was wide open, draining freely; and bilateral sixth paralysis was slightly better. At this time I personally couldn't get away from the fact that all this trouble began with an earache. The longer I practice medicine, the more I feel that if there is a point of supuration the cause should be ascertained.

Dr. Barkhorn explored both sphenoids through normal openings, enlarging them; a gelatinous cystic mass was removed from the right side, followed by about 15 drops of seropurulent liquid. Both labyrinths responded normally to the caloric test and the past pointing was normal. No chills. Dr. Eagleton insisted all this time that the ear was the most likely cause of it all, but said he had never seen an abscess of the nasopharynx in such a case.

On January 13, 1919, as optic neuritis was worse and there were hemorrhages in the right retina with persistence of septic temperature, diagnosis of cavernous sinus thrombosis of sphenoidal origin was made. Blood culture was done, but incubator failed to work properly. On January 15th both sphenoids and the posterior ethmoids were examined under cocain anesthesia. Nothing new, except hyperplastic mucous membrane was found. Both recti materially better. Optic neuritis worse. On January 16, 1919, patient getting progressively worse; sepsis continuing. Lastly decided to open the mastoid and explore the sinus, but the patient died while being shaved for right mastoid operation.

Postmortem examination showed a wet brain, with a small chemosis over left parietal hemisphere. Pus and cholesteatoma in the right mastoid with excision of the bone over the sinus. Free pus in the sinus, old organized clot in the lateral sinus extending from the right side to within an inch of the left mastoid; free pus in old clot in right inferior petrosal sinus, and free pus in entire cavernous sinus on both sides. This man had no occipital sinus whatever, on both sides. Right superior petrosal could not be found. Pus in both sphenoids, which may, however, have come up from the throat. On milking the right external jugular, free pus came up from the bulb.

The point of special interest in the case, to which attention is called, are, first, that bilateral paralysis of the sixth nerve is not a localizing feature, showing as it does, only increased intracranial pressure; second, that a retrograde process is possible from the lateral sinus and jugular bulb, through the inferior petrosal to the cavernous sinus, and thence through the pterygoid plexus to the throat, to form an abscess in the nasopharynx, instead of the re-

verse process, through a peritonsillar or other abscess through the pterygoid plexus to the cavernous sinus. Third, given a chronic running ear with evidences of intracranial pressure, the law of chance is always in favor of the ear as the etiologic factor. Fourth, there was no exophthalmos, etc., because it was a slow process of venous drainage through the vesalius and other veins.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL
SOCIETY.

Meeting of October 6, 1919.

THE PRESIDENT, DR. ELMER KENYON, IN THE CHAIR.

**Paper: "Suspension Laryngoscopy as a Means of Diagnostic and
Operative Approach to the Larynx."**

By R. C. LYNCH, M. D.,
New Orleans.*

**Paper: "Direct Laryngoscopy Without Suspension as a Means of
Diagnostic and Operative Approach to the Larynx."†**

By STANTON A. FRIEDBERG, M. D.

Dr. Otto T. Freer discussed

**Indirect Laryngoscopy as a Means of Diagnostic and Operative
Approach to the Larynx.**

Dr. Freer said that direct and suspension laryngoscopy had been understood by many as displacing the indirect method, for the removal of intralaryngeal growths, and this attitude was leading to an unfortunate neglect of the acquirement of proficiency in mirror operative work in favor of the easier technic of direct laryngoscopy, the result being that disproportionately formidable and forcible procedures are used for the removal of solitary papillomata and fibromata which could be deftly and quickly removed by the mirror method without the patient's being aware that he was being operated upon. The difference between direct and indirect operating in these cases being that between forcible entry into the upper air passages and elegant sleight of hand accomplishment of the same end.

The indirect method had been greatly improved in modern times by special electric illumination which represents an enormous advance in lighting the larynx since the days when Manuel Garcia founded the science of laryngoscopy. It was wonderful, however, what the old heroes of laryngology accomplished with the shadowy light reflected from a student's lamp or an argand burner. The use of brilliant electric bulbs for reflection was a great improvement over such lights, but laryngeal and tracheal lighting still remained primitive until the lamp devised in accord with optically correct principles by the genius, Kirstein, of Berlin appeared, the Kirstein lamp, which its author called "the shining eye," as its rays are parallel to the axis of the eye and hence virtually are emitted by it. The Kirstein light emits a long searchlight pencil

*See page 416

†See page 410.

of light, so that it has a practically endless focus and is always in focus for any object, whether two inches or twenty feet away. Thus it will light the walls and bottom of the longest bronchoscopy tube with equal brilliancy so that fine print may be read at the end of the tube. The popular head mirror, on the other hand, does not give a long pencil of light like that of a searchlight, but has a focal point of from six inches to twelve inches, the intensity of illumination rapidly diminishing a few inches in front of and behind this focal point. For this reason the head mirror has no depth of illumination, and even with a bright light for reflection will only light up the first few rings of the trachea, while the Kirstein lamp will brightly illuminate the bifurcation of the bronchi, a thing the head mirror can only be made to do if sunlight is used. The Kirstein lamp has been made many times more effective in late years by the use of the three filament, or "umbrella filament" miniature lamp devised by Brünings. Unfortunately, because of war effects, the Kirstein lamp is practically unobtainable and a supply from Germany must be awaited.

The Kirstein lamp requires a rheostat to regulate the brightness of the light and a carbon lamp in series to diminish the current, so that the little lamp may not burn out. Unfortunately, almost uniformly, the dealers sold the lamp with a carbon resistance lamp of small amperage so that the Kirstein lamp could only give a dim light when connected. This led many who did not understand the matter to return the lamp to the dealer and had hurt the popularity of the lamp.

Another improvement in laryngoscopy of recent date has been the use of thin laryngeal mirrors. Laryngeal mirrors give a double image, a brilliant one from the mercury back and a shadowy one reflected from the surface of the glass. This shadowy image is not noticeable where a thin mirror is used, but is very disturbing in a thick mirror. At present the thin mirrors are scarce, as they are of German make.

Of late Dr. Freer has been using anesthesin as a local anesthetic in laryngoscopic examinations of short duration. It acts much more promptly than cocaine and does not lead to the temporary retching that is often created by cocaine in sensitive throats. It is used in powder form by insufflation. The anesthesia is rapid but transient. As anesthesin is entirely nontoxic, it forms a very desirable substitute for cocaine.

The unpleasant features of suspension laryngoscopy are not enough emphasized. Pain in the teeth, inability to swallow for a day or two, and stiffness and pain in the neck may follow the procedure, especially in the case of adults, with rigid, short necks. There is a great difference in individuals in regard to the ease with which a complete view of the cords may be obtained, and Dr. Lynch's adjustments have to be used with undesirable force in a number of cases, while in others the laryngeal interior is seen with delightful ease. However, whatever the position used, the new one of Dr. Lynch's or the Killian, the fact is that the tongue is crushed down until the chin and sternum are in a straight line, while the tenseness of the skin and tissues between these two points is like that of a violin string. Such a procedure is vastly more uncomforta-

ble to the patient than the passage of a mirror and of delicate forceps into the throat. He suggested, therefore, that suspension laryngoscopy be reserved for the cases of extensive intralaryngeal disease beyond the limited capacity of indirect laryngoscopy. That method and direct laryngoscopy are the higher court, as it were, but the indirect method should be used first whenever feasible.

To ease the strain on the teeth in suspension, Dr. Freer found Dr. Lynch's dental spoons, molded to the teeth by filling of the spoon with a plastic, hardening dental mass, a perfect protection and did not feel like giving them up, though he had learned that Dr. Lynch no longer used the spoons.

Both suspension and direct laryngoscopy distort the region of the tongue and epiglottis, and the instruments used even cover up the tongue to the epiglottis so that the region of the valleculæ, of the base of the tongue and of the lingual surface of the epiglottis has to be treated by the old indirect method because unsuited to the direct one.

Dr. Freer could not understand why Dr. Chevalier Jackson and Dr. Friedberg denied children local anesthesia in their direct laryngoscopic work. Why not let them have the comfort of an anesthetized throat? Dr. Freer had cocaineized the throats of children for many years in order to see with the postnasal mirror, and they usually permit its use if they are older than four years. The great Englishman, Sir St. Clair Thomson, recently advocated cocaineization of the trachea for manipulations therein, and Dr. Freer had found the absence of cough reflex following its use in the upper air passages and trachea a great help.

It had been stated by Dr. Friedberg that there was no danger in passing a bronchoscopy tube through the glottis in children. This was not the speaker's experience. He referred to a case where after a preliminary tracheotomy done as a precaution he carefully passed a tube without difficulty through the larynx and extracted a piece of bone from the trachea. A few hours afterward edema of the glottis developed, which would have led to suffocation but for the tracheotomy tube in the trachea. Edema of the glottis also occurred in another patient saved by the same measure, a preliminary tracheotomy. A third case had come to the speaker's knowledge where the lack of a preliminary tracheotomy led to the suffocation of the little patient who had been subjected to bronchoscopy. Towards the end of his career Dr. Ingals told him that he felt more and more in favor of lower direct bronchoscopy for children, as it made the search for foreign bodies so much easier and shorter and safer.

The position for direct laryngoscopy mentioned by Dr. Friedberg, with the cervical part of the spinal column bent forward and the head extended backward at the occiput, was first described by Boyce.

Dr. Freer thought that the surgery of the larynx in malignant disease was being greatly changed by the use of radium. By means of hollow steel needles heavily screened with platinum and containing 5 to 12 milligrams of a radium salt or of radium emanation, the needles devised by Dr. Frank Edward Simpson of Chicago, it has become possible, using a needle introducer devised by Dr.

Freer, to introduce these needles into any part of the base of the tongue, the valleculæ, the aryepiglottic folds, the vocal cords or ventricular bands, the needles being secured from being swallowed or lost by a stout silk thread passed through the eye of the needle and attached to the cheek by adhesive plaster. The needles are left in the tissues for from six to fourteen hours. Both the needles and the holder were mentioned last July and shown in an illustration in the *Journal of the American Medical Association* by Dr. Robert Herbst, without credit to either Dr. Simpson or Dr. Freer, and he found it necessary to mention this here to secure their priority. Previously to the appearance of Dr. Herbst's article he described the needle and introducer at the 1918 meeting of the American Laryngological Association, and this description was published in the *Transactions of the A. L. A.* for 1918.

To show the influence of the needling in a favorable case, three needles were introduced into the base of the tongue and epiglottis of a patient who had a cancerous ulceration of those parts, the microscopic diagnosis of carcinoma having been made by Dr. Gordon Wilson. After four months of pain and gradual shrinkage and cicatrization of the affected part, all signs of carcinoma disappeared and the patient had remained well since then, a period of two years. Where a malignant growth has entered too far into the deeper and vital tissues, so brilliant a result may not be expected, but in the speaker's experience there are few cases that do not show marked improvement.

The advantage of the radium needle over the surface application of radium is that the radiation takes place from the heart of the growth and so reaches all parts of the cancerous mass, including its depths, evenly. Several needles are used, so that the desirable "crossfiring" of the rays is obtained. The vulnerable integument is spared so that ulceration does not occur. The needles are so well screened that in the rather extensive use of the needles he has never seen a radium burn.

DISCUSSION.

Dr. L. W. Dean, Iowa City, said that for many years he had thought that he was imitating the technic of Dr. Lynch in doing the suspension work on the larynx, but since seeing him work and talking with him he had come to the conclusion that this was not the case. In only a few cases of tumor of the larynx had he thought of using the general anesthetic. He cited the case of a patient seen recently with what he diagnosed as laryngeal tuberculosis. The patient had a strongly positive Wassermann reaction, and in spite of the clinical picture they were in doubt as to what the condition was. With their ordinary procedure of giving a hypodermic of morphin and atropin and cocaineizing the larynx, using cocaine and some adrenalin on a cotton swab in the larynx, placing it in contact with the larynx for some length of time, they produced anesthesia so that the patient was readily suspended, and fully twelve individuals walked around and took a look at the larynx with the head mirror. The patient was perfectly quiet. They had no difficulty in removing a piece of the growth for examination. With infants and very young children he used a Jack-

son's speculum for the examination of the larynx and removal of pieces for diagnostic purposes. He felt that infants and very young children could hardly be controlled under local anesthesia sufficiently for suspension laryngoscopy. He did not see many laryngeal tumors and had not much experience in the removal of these growths by suspension or other methods. He did, however, see a great many cases of laryngeal tuberculosis, and in his judgment Dr. Lynch's was the best method of handling these cases. Before Dr. Lynch furnished the profession with these excellent instruments he was accustomed to use the direct speculum. With the introduction of the Killian method he used that, but it was unsatisfactory, and he went back to the direct method. When Dr. Lynch gave the profession his suspension apparatus he adopted that in his clinic and has used it exclusively since. The patients were not necessarily suspended by himself; sometimes they were suspended and treated and cauterized, or what not, by the junior assistants. They did the work very nicely. He considered the method an easy one. But at the same time he had tried, under general anesthesia, to suspend and expose a growth similar to the one Dr. Lynch had operated at the clinic, and remove the growth, but he had not been successful. In his opinion, for the most difficult cases the operation certainly needed a master hand. After having seen Dr. Lynch do the work he was sure that he would be able to do better work with similar cases in the future, as he saw where his technic could be improved.

In many instances under local anesthesia, when the cases were suspended the patients thought they were going to choke and suffocate, but he had been able to overcome this by reassurance. As a rule there was no difficulty, even at the first suspension, and none at subsequent ones. After the patient was suspended, then came the question of removing the tuberculous mass and then cauterizing the edge. In his opinion, much better work could be done in suspension, using the long needle, so that the right hand could be steadied with the left, and he believed this far preferable to the direct or indirect laryngoscopy.

Dr. Dean asked for an expression of Dr. Lynch's opinion as to the use of local anesthesia.

Dr. Lynch (replying to Dr. Dean) stated that he had probably used local anesthesia less than he should. His patients readily consented to the general anesthetic, and he had never had accidents with it which would make him change from a general to a local anesthetic. It might be different with tubercular patients with involvement of the larynx of a tubercular nature who are naturally weak. He had had some cases suspended for one hour and one for three-quarters of an hour under local anesthesia with perfect comfort so far as the patient was concerned and no particular pain afterwards, except perhaps a little pain on moving the head forward, or at the corner of the jaw. In one instance a young negro was suspended and some seventy men viewed her, this being done under cocaine, with her apparent comfort. As a general rule, the cases coming for suspension were of two classes: either the child in which the local anesthetic was of no value, particularly as they were naturally frightened by the procedure anyhow. If someone could anesthetize their psychologic condi-

tion, then the local anesthetic would be ideal. In the adults, where the condition is not tuberculous, he could see no advantage in local over general anesthetic, aside from the fact that the operation was apt to be a failure under local if the tension of the muscles was too great to permit of a straight view. This was true particularly in cases of carcinoma and malignant tumors of the larynx. It was quite likely that the last case seen at the clinic could not have been suspended under local anesthetics. The point of trouble was too far away to suspend him with any degree of comfort to himself. It was very difficult to do good work if the patient was showing outward evidence of suffering. In his opinion, it was possible to do suspension under local anesthesia when the psychology of the patient was right, where the disposition of the patient was right and where those things prevailed in the same individual, especially if the procedure was not a long one. He certainly would not attempt the dissection of a malignant tumor from the larynx under a local anesthetic, because one might get started and have to stop because of the inherent fear that the patient has of choking to death, and if, as sometimes happens, one had to stop operation for the insertion of a rubber tube for breathing purposes, that would greatly frighten the patient if he was under local anesthesia. In his opinion, suspension was practical under local anesthesia if conditions were proper for it. If not, the local anesthetic was contraindicated, and the general anesthetic was the most satisfactory most of the time.

Dr. Stanton A. Friedberg thought that in very young children there was very little to be gained under local anesthetic. The child was frightened before one began work, and the mouth had to be forced several times in order to apply the anesthetic. The fright was increased as the examination continued, and it was doubtful if the deeper part of the larynx could be reached. With the direct method it was a simple matter to introduce the speculum and the bronchoscope also, if necessary, and delay was avoided. There was, of course, some discomfort connected with the method, but there was a question as to whether or not cocaine in children was dangerous. He recalled that several years ago Ingals had stated that death had occurred in young children in two instances where no other reason could be ascribed than the use of cocaine. He felt that the advantages, if any, were outweighed by the disadvantages, and that one was really doing the best for the child by doing the work as rapidly as possible. As a matter of fact, there was more discomfort than actual pain connected with the examination, as the statements of children old enough to understand will prove. He was not a fanatic, as Dr. Freer had inferred, in the matter of the use of direct laryngoscopy. There were many things which he liked to do with the indirect method also.

Dr. Thomas Hubbard, Toledo, Ohio, said that in a special art like suspension laryngoscopy, it was a good thing to get down to details. Dr. Lynch had developed a very important instrument—an improvement on the Killian—but there were certain precautions on account of the increased strength. Dr. Lynch, in clos-

ing the discussion, would do well to emphasize these points. He had noticed at the clinic that the incisor hooks rested against the front teeth and there was danger of an accident. Dr. Lynch has had so much more experience in this line he should give his conclusions in closing the discussion.

The length of the spatula was another important thing, and he thought a good many operators had failed because they had not properly adapted the spatula. The downward thrust screw increases the length, but in his opinion it was better to have the proper length spatula than to try and increase it by the downward thrust. One cannot always judge the length of the spatula to be used by the size and age of the patient, for the depth of the larynx may vary in patients, even of similar age and physique.

There was one thing about suspension laryngoscopy which has a bearing on the question of general anesthetic. In observing the cases at the clinic in the afternoon, one saw that with the first insertion of the spatula there was interference with respiration, a transient cyanosis. That meant that the spatula pressed upon the arytenoids and brought them slightly forward, and before it got to the anterior angle of the larynx it probably closed it to respiration. Following that, the respiration was perfectly free. Anesthetists were more and more convinced that dyspnea, cyanosis or asphyxiation are factors in shock, varying in severity in individuals. In many cases, and particularly in mouth and throat operations, the degree of shock may be determined by degree of cyanosis. There was one comforting thing about suspension laryngoscopy: one feels that he can secure free respiration, even more positively than with a tracheotomy canula. With control of the tongue and an open larynx, this element of shock is removed. These patients come out of the suspension operation with a minimum of shock and with very little or no traumatism. These factors, in his opinion, removed objections to the general anesthesia, and in his work he was very partial to a deep ether anesthesia. Morphin and atropin should be used sparingly.

Dr. Hubbard was very glad to hear Dr. Freer speak of the Kirstein light. In his opinion, Kirstein was the genius who made possible all of this progress. He left the practice of medicine in disgust because his method was not properly recognized. The headlight and also the spatula for direct examination of the larynx paved the way for bronchoscopy. Suspension laryngoscopy is today the crowning achievement, and we all honor Dr. Lynch for his part in perfecting the method. It is a great accomplishment to aid in developing intralaryngeal surgery up to the point where it can be called deliberate, precise surgery.

Dr. Harry L. Pollock, Chicago, said that he had had the pleasure of reading a paper on this subject three years ago, at which time Dr. Lynch was present. At that time Dr. Pollock stated that they had tried Dr. Lynch's method of suspension—that is, his position relative to the table. They had been in the habit of hanging their patients over the top of the table and suspending them after the fashion of Killian, but this method had not been successful in their hands. It was not until the spring of 1919 that the speaker had the pleasure of visiting Dr. Lynch and seeing

him use his method, that he realized just what it meant, since which time he has been using this method and could truthfully say it is much more simple than hanging the head over the edge of the table.

In regard to the use of anesthetics, it was their custom to use local anesthesia, particularly cocain crystals, by means of the applicator tube, in 1/10,000 adrenalin, for the purpose of taking up the cocain. He had never seen any cocain poisoning. Once in a while, when it was necessary to use a good deal of the drug, they did get a little exhilaration, but that subsided quickly. Four years ago, at one of the society meetings, Dr. Pollock had suspended a patient, and he had been in that condition for forty-five minutes without any discomfort—in fact, he seemed to rather enjoy it. In young children it was different, and one had to have a general anesthetic. In the beginning the patients would complain of the choking feeling, but if they were told beforehand that the medicine would make them feel as if they were going to choke, after the first little attack was over they would lie quiet and he could keep them suspended for half an hour without any trouble. There was no pain except a little at the back of the neck, and sometimes if the hooks that hold the teeth were not properly adjusted they complained of pain in the upper teeth.

He did not know whether it was possible to use a cautery with safety in general anesthesia, but a week or so previously he had had a patient sent to him who had a web at the anterior commissure, so that there was only a little breathing space. This had been cut twice, the last time six months before. He thought the best way to remove it would be by means of the cautery, and he suspended the young lady without any difficulty and used this cautery, but it was necessary to use both hands to hold the cautery point. The cautery point was quite long, and it would shake a little bit unless it was steadied with the other hand, when it could be put where one wished it.

They had not had many cases of tuberculous laryngitis, but in those few it was easy to suspend them by local anesthesia, and they could be curetted with a long curette just where one wished to use it, steadying the right hand with the left. It had been his custom to apply a little trichloroacetic acid on the end of the probe over these ulcers, and that could be done in just the same way. In cases of simple multiple papilloma, he thought they could be suspended under general anesthesia. Just recently a patient was suspended and choked very rapidly, and it was necessary to do a tracheotomy, and after this was done he was suspended again and curetted and the entire mass was removed. The tube was left in for four or five days, but it was plugged up to see if the patient could breathe all right before removing the tube. As there was no difficulty, the tube was removed and the tracheotomy wound healed rapidly. This happened three or four months ago, and the child had been perfect ever since. He thought Dr. Lynch had stated that the simple papillomata of children, if left alone until they were seven or eight years of age, would gradually disappear spontaneously. This boy he had referred to was eleven years old, and the papilloma started when

he was ten. At the time Dr. Pollock read his paper Dr. Lynch stated that he had operated on one case thirty-three times for multiple papilloma. In Dr. Pollock's experience it was not necessary to operate so often. Dr. Lynch said he sometimes operated every two weeks, but the speaker did not think it was necessary to operate until the mass had filled up the larynx again, and then it was not necessary to do so many suspensions.

Dr. Pollock could see no comparison whatever between the two methods for laryngeal work. Of course, in the examination one used the two methods; direct laryngoscopy was not used for simple examination; but if there were tumors in the larynx, the principle thing was that one had the field in front of them and they could work with both hands free, a big advantage over having one hand only.

Dr. Stanton A. Friedberg was of the opinion that all three methods were necessary for laryngologic work. If a patient came in with a little nodule on the cord, it could be approached with infinitely less trouble by the indirect method. The point he made was that the direct speculum was of especial value in young children, and in certain simple operative procedures. In conditions that were especially difficult it could not be compared with suspension. Each method had its distinct advantages and in order to perfect oneself in laryngology it was necessary to be familiar with all. There were some things which Dr. Lynch did under suspension that Dr. Friedberg thought he could do as well under simple direct laryngoscopy. He recalled that at one time Dr. Lynch advocated suspension laryngoscopy as a preliminary to bronchoscopy, but the speaker felt that he could do the latter as advantageously and in less time by the simple method.

Dr. Lynch thought that everyone was of the same opinion so far as the merit of suspension was concerned. He thought nothing would ever replace the mirror in laryngology, but if it took one as long to learn how to properly remove a tumor from the larynx with the forceps and a mirror—if it took him as long to use suspension as it did to use that operation he was afraid that suspension would have been given up long ago. He went through the school of indirect laryngoscopy long ago, and it took a great deal of practice and perseverance in order to do the operation artistically, for primarily it is an artistic operation. There was no doubt that a great deal of work that was done under suspension could be done under the indirect method. Certainly a large part could be done by the direct method, but when one had learned suspension it could be done best by suspension.

As to the tooth plate, at home he used lead foil, about 1/16 of an inch thick, folding it over the incisor teeth a little, the portion that runs upon the gingival mucous membrane, and permitting it to project down far enough so as to make it take up some of the pressure of the outward pull. As a matter of fact, in the new position the outward pull was very slight as compared with the old position, and since he used the new position with the lead foil, he had no accidents whatever. He always reported accidents as well as the successes, for he felt that it was proper for the profession to know what had happened to him

in order to avoid it themselves. In one case they broke six teeth from the upper jaw with a portion of the alveolar process, the patient being hung in the old position. The man is 68 years old, with perfectly good teeth; they were worn down considerably but seemed to be thoroughly fixed in their alveolar process, but six of them broke off. They were wired into place and fortunately grew back in again. This man had a cancer of the larynx. He thought it might be interesting to know that tracheotomy was performed on him and 55 mg. of radium put into his trachea, tied in between two threads, one tied to the back teeth of his upper jaw and the other to the opposite side. They had a good view of the larynx to see that it was in opposition to the growth. This was left in for eight hours. There was no difference appreciable in two weeks. The same application was made at the end of four weeks, the same amount of radium being left in four hours. Following the second application of radium, in two weeks, evidences of a radium burn began to appear around the tracheotomy wound, with no evidence of burn around the larynx. The man died from hemorrhage of the internal jugular, which started from a slough from the burn around the tracheotomy wound. There was no evidence of radium burn about the larynx.

Dr. Lynch was of the opinion that the selection of a spatula for the individual case was a matter of experience. The best way to judge this was by accustoming oneself in tonsil operations to the distance from the upper jaw to the epiglottis. By trying the spatula first, as he had suggested before, with a mouth gag in place, one can lift with his hand so as to see the epiglottis, and in many instances one would be surprised at the view that could be obtained. He thought it was much better to fit the spatula to the case than to depend upon the screw to drive it down over the face of the epiglottis. The best views were acquired when the spatula was fitted right than when it was made longer by changing the screw. The best method was to deliberately place the spatula on the base of the tongue, so as to leave the epiglottis free. This had two advantages; it brought the epiglottis into view for operative work, and bringing it into view better than where the tip of the spatula dips down into the larynx so that the arytenoids are interfered with. He preferred not to have the tip of the spatula so far down. As long as the epiglottis was out of the way, the movement of the vocal cords did not seem to interfere. He could not see any particular advantage by having the spatula go deeper than the cavity of the larynx.

As to the question of cyanosis as associated with shock, they came into contact with that sometimes in papillomatous cases, and in many instances suspension of these cases had to be done rapidly with the idea of passing a bronchoscope for the maintenance of respiration, until the cyanosis had cleared up and the respiration was carried on with the bronchoscope in situ so it was well to open up the field sufficiently wide that respiration might be carried on without the aid of the bronchoscope. In some of the papillomatous cases obstruction was extreme, and they never entered one of those cases without a tracheotomy set at hand. So far they had not had to do a rapid tracheotomy

on a patient while being suspended, but they had saved themselves from this on a number of occasions by the rapid introduction of the bronchoscope when the suspension apparatus had been properly placed.

In the local anesthesia in suspension, it had been his custom to cocaineize the uvula, with a cotton mop saturated with one per cent of cocain, and then one application of this to the tongue at the lingual face of the epiglottis, and then two or three applications of the powdered cocain dipped in adrenalin to the base of the tongue, the laryngeal face of the epiglottis, and the upper surface of the arytenoids, and then drop two to four drops of a ten per cent solution of cocain into the larynx. That gives sufficient anesthesia to permit of proceeding with the operation. He thought that the comfort of the local anesthesia might be increased by a previous dose of morphin and scopolamin, which they had used a good many times with success.

As to the use of the cautery in general anesthesia they used it in many cases under general anesthesia and had no accident to report up to this time. The technic in this operation is that the cautery point was tested away from the ether and ether apparatus with care and the point was placed in contact with the growth before the heat was turned on. If it was not too hot, there was no danger of explosion with ether or ether vapor. They had cauterized a sufficient number of times to say that there was no danger, if this technic was followed.

Linear cauterization for reduction of hypertrophy of the vocal cords, occurring either previous to or following endolaryngeal operation, would tighten up the cord and reduce its size, and restore the voice, in what might seem a most remarkable way. This was done with a Yankauer cautery with the finest point.

In regard to papilloma, their cases so far numbered fifty-five. The younger the papilloma the harder it was to control and he agreed with Dr. Pollock that the fewer the operations the better for the patient. He had had sixteen cases without recurrence, removal without recurrence, and the older the patient the less likely there was to be recurrence, and the most pedunculated the papilloma the less likely the recurrence. He had run into a class of papillomas which were as near malignant as anything he had ever seen, except the induration, the involvement of the subcutaneous or submucous tissue and metastases. He thought there was no doubt but that there was a psychologic moment for the disappearance of papilloma. He believed the best method for the treatment of these conditions was a cauterizing agent or dessicating agent, such a fulguration, or the acid nitrate of mercury. The acid nitrate of mercury, sixty-two per cent U. S. P. had given him more comfort from the chemical standpoint than anything he had ever tried, and the fulguration more than any electrical appliance. In his fifty-five cases of papillomas two were females, the rest males. About two weeks previously he had had a very unusual accident in one of the papillomatous cases. This was a little girl three and a half years old on whom they had operated five times in a year and a half. At this sitting there was one mass growing from beneath the right cord and

two small blood tumors growing in the neighborhood of the ventricle above the cord. The fluid masses were cauterized with actual cauteries and the small mass below the cord was removed with forceps and knife, and the base was cauterized with acid nitrate of mercury. Nothing occurred at the time of operation which made him feel the least concern for the little patient, and this was done at ten o'clock in the morning. At three o'clock in the afternoon she developed emphysema, which necessitated tracheotomy for its relief at nine o'clock that night. He had no idea why the emphysema occurred, but told of it as one of the things that one might find of value. At the present time he could say he considered the dissection of a papilloma from the larynx an unsuccessful procedure, and wished to contradict what he had said five years ago. That is, if a papilloma could be absolutely properly dissected from the larynx there would be no recurrence. He had felt on any number of occasions that he had thoroughly cleaned the larynx from any papilloma, with their almost immediate recurrence, and he now felt that some of these cases now under his observation and had been for two years were at this time worse than when he started on them. They had thus far not lost a case in the fifty-five, and those that were cured were permanently cured and had tone to the voice. Of that number there were about twelve in the active state of medication, operative procedure, observation, etc.

Dr. Norval H. Pierce asked whether Dr. Lynch regarded suspension laryngoscopy as entirely replacing laryngofissure, and whether one could use fulguration during the general anesthetic.

Dr. Lynch said that he did not so consider it. He used fulguration during general anesthesia, using the military apparatus with the mouthpiece over the mouth, but before they start the cautery this is removed and the cautery is usually of very short duration. They use the same technic with fulguration that is used with the cautery point and have had no accidents with either one, but they never start the current until both the cautery point and fulguration point are in place for their work.

As to suspension and laryngofissure, he had mentioned the fact, especially in consideration of malignant cases, which cases are suitable for suspension and which for laryngofissure, and he thought that if a procedure could best be done by laryngofissure it should be done that way. He thought the selection of the best method was for one's own judgment, but it was very illuminating to him to do a laryngofissure with a patient under suspension. He thought if anyone could have an opportunity of doing or seeing an operation under that tube he would appreciate the great advantage of the two-way view.

So far as his personal experience went, he had never seen a cure of an intralaryngeal tumor of the larynx by radium. He had not used a radium needle as described by Dr. Freer and had none at his disposal. He had used radium externally and intralaryngeally, applied in proximation to the tumor, on any number of occasions, and had applied it in the esophagus on any number of occasions, and in not one of these could he record anything that he regarded as a cure of an improvement.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL
SOCIETY.

Meeting of November 3, 1919.

THE PRESIDENT, DR. ELMER L. KENYON, IN THE CHAIR.

Dr. C. Johnston Davis gave a lantern slide demonstration of
War Injuries of the Head.

In the radiographic examination of those cases of head injuries where the accessory sinuses or the mastoids were involved, or where disease was suspected, they used a technic which they found especially useful in exposing these regions. In the examination of the frontals, ethmoids and supramaxillary sinuses two plates were made—i. e., anteroposterior and lateral.

For the anteroposterior view the patient was placed prone on the table, the face resting on an 8x10 plate placed on an inclined plane. The degree of the plane was immaterial, for it was used only for the comfort of the patient. The tube was brought close to the head, centered and tilted so that the central ray passed through the head at an angle of 23 degrees to an imaginary line passing through the glabella and the external auditory meatus. In this position the shadow of the heavy petrous portion of the temporal bone was placed at the lower third of the orbit and the upper third of the antrum, a region of but little importance in the examination of these pneumatic cavities.

For the lateral view the patient was placed on his side, with the affected side of the head next to an 8x10 plate resting on a small platform. The head was so placed that the sagittal suture lay in the same plane as the plate. The head was then clamped in position and the tube brought close so the central ray passed through the pupils of both eyes when viewed from before backward and about 3 cm. posterior to the supraorbital ridge. In this position the depth of the frontal sinus and the thickness of the anterior and posterior walls were readily determined. It was absolutely necessary to know this before the character of the sinus disease could be determined. In this position the anterior and posterior ethmoidal cells showed clearly or not, depending on their being free from disease, also the shadows of the anterior and posterior clinoids and the lateral view of the sphenoid.

In examining both sphenoids the patient was placed in a sitting position, the chin projected forward, resting on an 8x10 plate placed on an inclined plane of 25 degrees. The tube was brought close to the head, centered and tilted so that the central ray passed through the head about 3 cm. anterior to the external auditory meatus, striking the plate a little short of a right angle. The developed plate showed the sphenoids posterior to the larynx and the degree of their involvement could readily be determined.

In the examination of the mastoids, both mastoids were placed on the same plate for comparison, the occiput being in the center of the plate. The patient lay on his side with the right or left mastoid, as the case might be, next to one-half of an 8x10 plate, the opposite half being covered with a piece of sheet lead. The pinna of the ear was folded forward and the head clamped in position. The tube was brought close to the head and tilted 15 degrees toward the face and 15 degrees toward the feet and so centered that the central ray entered the head at a point 8 cm. posterior and 8 cm. above the external auditory meatus of the upper ear—that is, the ear nearest the tube. This position showed well all the cells of the mastoid, including those cells which might be obscured by the posterior border of the petrous. Stereoscopic plates were made of all mastoids, which, compared with the flat plates gave much additional information.

The slides shown represented in a small way the type of head injuries received at the U. S. A. General Hospital No. 11, located at Camp May, N. J., and known as the Special Overseas Head Hospital. Cranioplasties were done in those cases where the loss of bone was so great that the operation was indicated for cosmetic or prophylactic reasons.

No attempt was made to remove deep intercranial foreign bodies. It was surprising to note how few were the symptoms produced by these pieces of shrapnel and high explosive shells. This might be explained by their position, the majority lying in the falx cerebelli. Those lying in the motor regions of the cortex and producing symptoms were removed by magnet, invariably with good results. They were much impressed with the clean condition of all the head injuries. Wounds were invariably sterile and in but a few cases had bone fragments or small foreign bodies been left.

The slides showing the injuries of the jaw and upper face represented the type of fractures with loss of bone tissue resulting from modern warfare. In a few cases they were able to demonstrate new bone cells, which was of great help in determining future treatment. In those cases where nonunion existed after three months' treatment bone grafts were used. Their experience agreed with that of the British, that it was a waste of time to expect union after this time. Where the X-rays showed teeth in the area of defect they were invariably extracted.

Chronic sinusitis was in a majority of cases due to retained small foreign bodies. The slides showed a few of these cases. An interesting case was one in which a small fragment of high explosive shell penetrated the right cheek and was found lying in the sphenoid at the midline. The only symptom was a slight restriction of both fields, which during the four months of observation gradually cleared.

All foreign bodies of the mastoids and sinuses with but few exceptions, whether producing symptoms or not, were removed.

DISCUSSION.

Dr. Joseph Beck took great pleasure in discussing the splendid presentation of Dr. Davis, and thought the society was greatly indebted to him for bringing such a wealth of material to them.

It would be of value to many men, particularly those who were still in doubt regarding the value of the X-ray in the diagnosis of sinus and mastoid disease. Most of the slides demonstrated war injuries and the presence of foreign bodies, conditions not often dealt with in private practice, but several interesting points had been brought out from the roentgenologic study. Many of the slides, as he viewed them, if they were single, were not anatomically correct and if one tried to base a diagnosis upon the so-called faulty position they would not get the true sinus and often got findings that were confusing.

He had followed the method as first brought by Killian and had never found it wanting; in having the patient placed on his stomach, or sitting up, with the head at an angle of twenty-five degrees from the flat table, when the picture was taken with the target above the occiput the result would correspond so exactly in size that he could take a model from the radiogram and find that it would not vary in the slightest. He would find the sinus just as the picture outlined it. For single pictures Dr. Beck thought this position was the best.

In the stereoscopic photograph it did not matter whether the head was flat on the table or not, because when the pictures were placed together they gave the position in which the head was taken. If the head was flat on the table the plate would give the exact position and, consequently, the pathologic condition could well be made out.

Dr. Beck was glad that Dr. Davis stated that the pathologic condition was shown by the radiogram. He had spoken several years ago of making a diagnosis of the various kinds of mastoid disease, especially in the acute forms of ear diseases, but it was also possible to make it in the chronic conditions. For instance, in fibrosis of the bone, associated with fistula formation, and with fistula and cholesteatoma cavity, of syphilis and tumors, it could be quite easily done. In the acute conditions he could easily separate the pathologic conditions by means of the X-ray picture, from those of the confluent conditions and those much more grave conditions of the osteophlebitic type in which the cells were still retained and the picture was darker because the bone was still present. This was a very important point in diagnosis. He had been using, for more than three years, the Roentgen ray in the diagnosis of otosclerosis. Whether this would be of value or not was still to be proven when the cases could be diagnosed postmortem, but clinically he could show early cases of otosclerosis, rapidly progressing cases with the retrogressive change of the bony capsule of the labyrinth in the vicinity of the fenestra ovals.

Dr. Alfred Lewy asked Dr. Davis to repeat in detail his technic in mastoid diagnosis.

Dr. C. Johnston Davis stated, in regard to the position for sinus examination, that several positions had been worked out by different men. The position he described he had found to suit his purpose very well, but nearly every man who attempted radiology of the head employed his own particular technic. In diagnosing sinus plates the entire plate must be considered. In

many instances the report of the radiologist stated that there was a shadow in the region of the left antrum or frontal sinus. The shadow *per se* meant nothing; it might be a normal shadow for that sinus. With a shallow sinus, or a sinus with a very thick wall, there would be a more or less dense shadow which would simulate the shadow of a very deep frontal sinus with granulation tissue or dense pus. So it was necessary to study the density of the plates before attempting to interpret the shadows.

Regarding the diagnosis of the different forms of mastoid disease, they had found in the army that they could give the surgeon a great deal of information, especially after making the stereoplates, which he was unable to obtain in any other way. At Manhattan Eye, Ear, Nose and Throat Hospital, New York, they had used the single plates and their diagnosis was limited to the gross pathology. In the stereoplates they could look into the cells very clearly, and had been able to distinguish between granulation tissue and pus in a few cases, but not between thin pus and fine granulation tissue. Both mastoids were taken, for comparison. They had evolved a technic whereby both mastoids could be placed on the same plate, and studied stereoscopically. After the head was placed on the plate the tube was centered so that the central ray would pass through the mastoid at an angle of fifteen degrees toward the feet and fifteen toward the face.

Paper: Dermoids of the Anterior Mediastinum, with Report of a Case.*

By ROBERT SONNENSCHN, M. D.

DISCUSSION.

Dr. A. A. Goldsmith said that he had the pleasure of seeing this patient four or five years ago and he believed that if he saw a similar case today he could come to better conclusions than he could at that time. Some X-ray plates had been taken at Wesley Hospital, but had been destroyed. With the improved technic of today one could come to the decision, at least, that they were dealing with a cyst. The average malignant tumor in the mediastinum was usually irregular in shape, rapid in growth, and in the X-ray showed finger-like processes running out in all directions, whereas with the dermoid one saw a well-rounded cyst outline. In this patient he had thought she was suffering from a thymus, because that was the ordinary thing to be thought of.

In differentiating between malignant tumors and benign the marked dyspnea and symptoms of pressure upon the veins should be considered. It was very common to have the enlarged veins upon the abdomen in these chronic cases, and that was less common in the acute forms. In this case the patient had beneath the sternum a mass which was accessible to palpation.

Dr. J. Holinger thought that the presentation of Dr. Sonnenschnein was interesting from the embryologic standpoint. He had hoped that the doctor would enter a little more into that phase of the

*See page 427.

subject. It was very peculiar to have a new formation of ectodermal nature between the mesodermal and endodermal structures.

Embryologically two features seemed to be very extraordinary in this tumor. The first one was that the location in the thorax showed that cell material must have been thrown in an abnormal position at a very early state of development, that is, before the thorax was closed. The second feature was that the tumor was not quite in the middle line.

Major W. F. von Zelinzki said he had seen an operation in Professor Sibleau's clinic in Paris for a growth of this kind located in the sublingual space and projecting into the mouth. Sibleau, who made the diagnosis, said that in all probability it was a dermoid cyst. The patient was a girl aged ten or twelve years, and the doctor thought these things were not uncommon. He made an incision below the inferior maxillary, in the median line, and shelled out a tumor the size of a small orange. He stated that hair or teeth were very rarely found in these dermoids. When the cyst was opened it was found to be filled with a sebaceous mass. The diagnosis was made by the history and palpation and the professor stated that he had had a number of similar cases.

Dr. Sonnenschein said in regard to the embryologic question that he had stated in the paper that it was the inclusion of ectodermal cells which produced dermoids. Where these developed in the cervical region of the fetus, they might descend into the chest, just as the heart and the laryngeal nerve were carried down. The growths might lodge anywhere in the thorax, between the heart and lung, or in the hilum of the lung, etc. It was true that the other organs in the chest were mesodermal.

In regard to the growth mentioned by Dr. von Zelinzki, it was true that dermoid growths might occur in any region of the body, but the most frequent place, according to the observations, was in the ovary.

Paper: The Lingual Duct in the Production of Paroxysmal Cough.*

By T. W. LEWIS, M. D.

DISCUSSION.

Dr. Robert Sonnenschein said he had never looked at the thyroglossal duct in this connection, and thought Dr. Lewis had been of much service in calling attention to this. The lingual tonsil, he was sure, was responsible for many coughs, and many cases had yielded to cauterization with the galvanocautery.

Dr. Lewis had felt rather chagrined when he encountered the first case not to know that there was such a thing as a lingual duct. When he found pus exuding from the base of the tongue and could not account for it. When the man with him, one of the best known men in the country, could not give him any light on the subject, and when he inquired of most of his friends and found that none of them could tell him the source of it, he felt that he was, perhaps, not alone in his ignorance. When he investigated and found practically nothing written on the subject of the lingual duct, he

*See page 422.

thought it might be a subject worthy of bringing before the society. If he had called attention to something that had been neglected or overlooked, or something that would promote investigation, perhaps someone would be able to see something more than he had seen.

Dr. Joseph Beck presented two brains showing

Tumor and Abscess.

The first patient was a woman aged 29 years who had been referred by Dr. Harry Gradle for operation for accessory sinus involvement. The patient, when referred to Dr. Beck, was rapidly losing her vision and Dr. Gradle had found nothing to account for this except a very large blind spot which was supposed to be of retrobulbar origin. She had been operated for goiter by Dr. Crile and had recovered except for the exophthalmos, which was very marked. Vision was reduced to 1/200 in both eyes. Examination revealed no evidence of sinus involvement except slight crowding of the ethmoid. A bilateral ethmoid operation was performed, the region being opened wide, and nothing particularly abnormal was found. Following this there was considerable improvement in vision for large objects, but in tests made for acuity of vision at a distance there was not much change. Aside from examination for sinus involvement nothing further was done. The patient gave a history of some noise in the right ear several years previously, but functional test was not made. There was no mention of headache and a slight unsteadiness of gait was the only sign of brain disturbance. The patient left the city and returned after six weeks. At this time there was a typical choked disc of nearly seven diopters and symptoms of brain tumor. Functional tests for the brain stem and vestibular apparatus revealed an absolutely dead ear; otherwise, normal in every way. A neurologist was called in consultation and made a diagnosis of retrolabyrinthine tumor, or tumor of the acousticus. Because of the choked disc and ataxic gait operation was decided upon. The cerebellar region was exposed bilaterally, slightly more to the right. The patient was turned with the face down so that the anesthetic could be administered from below. When turning the patient upon the abdomen the breathing became shallow; she was immediately placed again on her back and recovered normal respiration. After she recovered she was again placed face down and a large flap was removed from the region they wished to explore. There was considerable hemorrhage and when the bony flap was removed the patient stopped breathing again and attempts at resuscitation were of no avail.

Permission was obtained for an immediate postmortem and in the region of the cerebellum there was an apparently free tumor, with a well-defined capsule, located in the region of the pons and medulla near the vital center. The patient had never mentioned the fact that she could not lie on one side without disturbance, but the husband stated that she had told him that this was the case.

The second specimen was the brain of a young woman, 28 years old, married and the mother of two healthy children. She gave a

history of having had a suppurating ear for a number of years during childhood. Three years previous to examination she had an acute suppurating of the ear from which she never recovered. In June, 1919, she developed pain in the hear and a great deal of dizziness and vertigo. When the patient was brought to Dr. Beck by Dr. Novak it was decided that she had a localized labyrinthitis in connection with a chronic suppurating ear, and as the symptoms were so acute it was decided to postpone operation for a time. After two weeks Dr. Novak thought the patient had a cerebellar abscess and operation was decided upon. The usual operation was performed and the abscess was very readily located in the region of the under surface of the cerebellum in the region of the sinus. It was opened and drained and very foul pus escaped. Bacteriologic examination showed a fusiform bacillus. A drain was inserted and after about a week the patient was able to get up and was getting along well. About ten days after the operation the drain was removed; there was no further discharge but at the place of drainage a small projection appeared and rapidly increased in size until it was as large as a small apple. As this hernia increased in size very violent headache developed. An attempt was made to replace the hernia, but this produced grave symptoms and it was decided to amputate it. This was done and the patient had considerable relief from symptoms, and then a sort of sac was formed and following this a fistula appeared which was thought to be a cerebrospinal fistula, and the patient grew gradually worse. She deteriorated mentally and gradually refused food until feeding had to be forced. This condition persisted until she became comatose and died on the 2nd of November. An immediate post-mortem was performed at six-thirty A. M. Two days before the patient's death Dr. Carpenter was in the city and assisted Dr. Pollock in reopening the wound at the site of the hernia, but nothing unusual was found but the hernial sac. Postmortem revealed an apparently normal brain with slight edema at the pons and a collapsed abscess, with the wall not as thick as a chronic abscess usually shows. When the temporal bone was removed they discovered on the posterior surface of the bone a fistula from the posterior semicircular canal. Stereoscopic radiogram of this temporal bone showed that the labyrinth was involved in a destructive labyrinthitis.

Histologic examination would be reported on subsequently. The patient showed a vertical nystagmus and he and Dr. Carpenter had decided that there must be some intracranial condition. The details of the tests and other examination would be reported fully at a later date, when the case would be reported in full. Today he wished simply to present two fresh specimens of brains operated upon.

DISCUSSION.

Dr. C. M. Robertson was of the opinion that Dr. Beck should report fully on the vestibular reaction, and asked if the pontine angle tumor had reached a size that would interfere with the opposite side sufficiently to eliminate the other labyrinth.

He also asked if, when the hernia was removed in the second case, a part of the cerebellum was also taken away, and whether

any peculiar symptoms followed the amputation—whether there was anything in the way of spasms exhibited.

Earlier in his career he was called in to give an anesthetic to a patient who was undergoing an operation for a congenital cerebellar hernia. The operator cut off about one-half of the lobe of the cerebellum, which produced a very decided train of spasms even under the anesthesia. The congenital hernia of the cerebellum was at least eight or ten centimeters in diameter. The child lived for two or three months following operation, but was unable to control its motions.

Dr. Robert Sonnenschein asked whether an X-ray had been taken in the first case to determine the condition of the auditory meatus.

Also, was it not true, in regard to the second case, that with the exception of a few centers, most of the cerebellum could be removed with safety? They were apparently silent areas and their removal would not produce marked symptoms.

Dr. J. Holinger, with the idea of adding a point to the difficulty of diagnosis in these cases, cited a case operated at the Cook County Hospital. The patient was a child who was first seen in an unconscious condition with a badly suppurating ear. Examination of the ear showed granulations and foul smelling pus filling the canal. This condition had been present for some time before the patient was referred to the otolaryngologic department. Operation was performed more with the intention of giving the child a last chance than a distinct expectation of cure. Extensive masses of necrosed bone were removed. The child rallied somewhat, asked for water and recognized its mother. A week later she became worse, and in his absence Dr. Meyer, under the impression that there was a soft spot in the bone which gave a typical parchment feeling, thought there was something to be found and entered the skull further back than the point of previous operation. He found nothing. The child died two days afterward.

A postmortem was obtained and showed an enormous brain tumor. There had been no symptoms to make one suspect anything of the kind. Examination of the brain showed the entire mass so completely out of its shape that it was almost impossible to recognize the different parts. There was a tumor at least the size of a small orange, which had pressed the pons and medulla and cerebellum entirely to one side. The medulla was not as thick as a lead pencil. The tumor took the place of one hemisphere of the cerebellum, and even the temporal lobe was pushed entirely to the front. That a tumor of that size could squeeze the parts so far out of place without producing symptoms was remarkable. The child had played and appeared normal up to ten days before entering the hospital. Questioning elicited the fact that she had been in the hospital for influenza several months previous, but had recovered and was all right until she was brought in again for treatment for the ear condition. She became unconscious in the hospital.

Dr. Michael Goldenburg was reminded of a case that came under his observation six or eight months ago. A child was brought to the infirmary at the suggestion of the family physician to have its tonsils and adenoids removed. This was accomplished with

nothing unusual developing. A few days later the mother brought the child back, stating that he had been blind since the operation. A fundus examination revealed a double papilloedema. On going into the history carefully a diagnosis of brain tumor was made. This was later confirmed by a neurologist and the following morning a subtemporal decompression was performed. The tumor was, however, deep seated and nothing could be accomplished.

Dr. Beck (closing) said that all the examinations and tests had been made and would be reported on fully at a later date. As Dr. Cushing said, the tumor in such cases enlarged the internal auditory canal, but there was no information to be obtained at that point in this case.

In the second case there were no peculiar symptoms following amputation of the hernia. Quite a portion of the cerebellum was removed, but there were no symptoms. If she could have been made to walk she might have exhibited symptoms, but as she was bedfast nothing was shown that could be referred to the operation.

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